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THE USE OF *BACILLUS WELCHII* (PERFRINGENS) ANTITOXIN IN EXPERIMENTAL GENERAL PERITONITIS AND INTESTINAL OBSTRUCTION *

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THE striking improvement of clinical aspects and the reduction of the mortality rate of acute peritonitis and of acute intestinal obstruction, which was reported by Williams¹ after the use of *Bacillus Welchii* antitoxin, made desirable further investigation of this mode of treatment of the two conditions. If the surgical treatment of peritonitis and of intestinal obstruction can be supplemented by another reliable method, their high mortalities may be reduced. This article is a record of our study by experimental methods of the value of *Bacillus Welchii* antitoxin in acute peritonitis and intestinal obstruction.

Impressed by the clinical similarity between acute intestinal obstruction and general peritonitis and the toxæmia of gas gangrene, Williams investigated the importance of toxæmia due to anaërobic organisms in the first two conditions. *Bacillus Welchii* was chiefly studied since it is the most abundant and constant organism found in the human intestine that is known to produce toxin. Williams found evidence of an immense proliferation of *Bacillus welchii* in the vomitus and in the contents of the small intestine of patients with acute peritonitis and obstruction. He also found evidence of the presence of *Bacillus Welchii* toxin in the contents of obstructed or paralyzed intestine and evidence of the absorption of the toxin from the intestine.

Williams made a therapeutic test of his hypothesis at St. Thomas's Hospital by the administration of *Bacillus Welchii* antitoxic serum in cases of general peritonitis and acute obstruction. A comparison of cases so treated with a control series showed a definite lowering of the mortality and alleviation of the symptoms and clinical signs. *Bacillus Welchii* antitoxin was administered to eighteen of the most severely ill of a series of 256 consecutive cases of peritonitis following acute appendicitis. There were three deaths, making a mortality of 1.17 per cent. A control series of 111 cases at the same hospital which were not given *Bacillus Welchii* antitoxin showed a mortality of 6.3 per cent.

* Read by title before the Central Society for Clinical Research, November 23, 1928.

Bacillus Welchii antitoxin was given in addition to operative relief to fifty-four cases of acute intestinal obstruction and there was a mortality rate of 9.3 per cent. as opposed to the rate of 24.8 per cent. in a series which did not receive antitoxin.

Bower and Clark² have reported the clinical use of *Bacillus Welchii* antitoxin at the Samaritan Hospital, Philadelphia, in eleven cases of acute diffuse suppurative peritonitis, nine cases of acute intestinal obstruction and five cases of acute suppurative cholecystitis. These authors have substantiated in this small number of patients the claims made by Williams. The patients suffering from peritonitis and intestinal obstruction who were treated with antitoxin were less restless, the pulse rate was diminished, the temperature was reduced, abdominal distention became less and bowel movements were begun earlier.

Experimental Methods and Results.—The first part of our experimental study was made by comparing the mortality rate in a control group of dogs suffering from acute peritonitis with the mortality rate in a similar group that were treated with *Bacillus Welchii* antitoxin. In fourteen dogs used as controls, the abdomen was opened under ether anaesthesia with aseptic precautions. The appendix was identified and together with the meso-appendix was ligated at its base. After closure of the abdomen, the dogs were replaced in cages and the day of death was recorded. In the experimental series of fourteen dogs, this same operative procedure was performed, but in addition, they were treated with *Bacillus Welchii* antitoxin.

TABLE I.—CONTROL SERIES

Four of the fourteen dogs survived ligation of their appendices. The average length of life of the remaining ten dogs was 4.2 days.

Dog Number	Length of life in dogs
1.....	Alive
2.....	2
3.....	12
4.....	3
5.....	Alive
6.....	3
7.....	Alive
8.....	4
9.....	2
10.....	2
11.....	Alive
12.....	4
13.....	8
14.....	2

In the control series of fourteen dogs (Table I), in which peritonitis was established by making the appendix gangrenous, four dogs recovered spontaneously. The average duration of life of the remaining ten dogs was 4.2 days. Post-mortem examination of the ten dogs that died revealed in each instance an acute general peritonitis. Examination of the four dogs that sur-

BACILLUS WELCHII ANTITOXIN IN PERITONITIS

vived a few weeks until sacrificed showed evidence of having had an extensive peritonitis.

In the experimental series of fourteen dogs treated with *Bacillus Welchii* antitoxin,* four recovered. (Table II.) The average length of life of the ten dogs which died was 5.3 days. The dogs were given, during the first or second post-operative days when the animals became very ill, an initial dose of *Bacillus Welchii* antitoxin which averaged 1.7 cubic centimetres per kilogram body weight. This dosage is in proportion to the amount given to patients by Williams. The initial dose was followed by a daily intramuscular dose of one-half to one cubic centimetre of *Bacillus Welchii* antitoxin per kilogram body weight.

TABLE II.—EXPERIMENTAL SERIES

Fourteen dogs with an experimentally produced peritonitis were treated with *Bacillus Welchii* antitoxin. Four dogs survived. The average length of life of the remaining ten dogs was 5.3 days.

Dog No.	Length of life in dogs	Anaërobic cultures			Wt. of dog per kilo	Dose of <i>B. Welchii</i> antitoxin	
		Peritoneal cavity	Abscess about appendix	Distended loop of intestine		Initial	Daily
15.....	17 sacrificed	—	—	—	20	54 cc.	18 cc.
16.....	3	—	—	—	10	30 cc.	—
17.....	8	—	—	<i>B. Welchii</i>	7.6	13 cc.	4.2 cc.
18.....	3	<i>B. Welchii</i> Culture not taken	—	<i>B. Welchii</i> Culture not taken	4.3	8 cc.	5 cc.
19.....	9	—	—	—	3.1	6 cc.	5 cc.
20.....	2	—	—	<i>B. Welchii</i>	5.8	15 cc.	—
21.....	4	—	—	—	4.6	15 cc.	8 cc.
22.....	2	<i>B. Welchii</i>	<i>B. Welchii</i>	<i>B. Welchii</i>	3.6	10 cc.	—
23.....	31 sacrificed	—	—	—	11	19 cc.	10 cc.
24.....	17 sacrificed	—	—	—	6.6	11 cc.	4 cc.
25.....	8	—	—	—	4.4	7.5 cc.	2.5 cc.
26.....	5	—	—	—	5	10 cc.	3.5 cc.
27.....	9	—	<i>B. Welchii</i>	—	8	13 cc.	5 cc.
28.....	17 sacrificed	—	—	—	6	10 cc.	4 cc.

Anaërobic cultures were taken at autopsy from the peritoneal cavity, from the region about the appendix and from a distended loop of intestines of the ten dogs. *Bacillus Welchii* were recovered from one or the other of these sites in five instances.

The second portion of our investigation is concerned with the value of *Bacillus Welchii* antitoxin in the treatment of experimental intestinal obstruction and peritonitis. A rapidly fatal lesion was established by making a short isolated loop high in the intestinal tract. Under ether anaesthesia with careful asepsis, the abdomen of the fourteen dogs in the control series was opened

* The antitoxic serum used in the experiments was prepared from the blood plasma of horses immunized against the toxin of *Bacillus Welchii* or *Bacillus perfringens*.

and at a uniform distance of 45 centimetres from the pylorus an isolated loop 15 centimetres in length was made. Care was taken not to damage the blood supply of the loop of the intestine. An end-to-end anastomosis was made of the proximal and distal ends of the intestine. The abdomen was closed without drainage. Death followed rather quickly in each instance. The average duration of life of the fourteen dogs in this control series was 2.3 days (Table III). A post-mortem examination of each dog revealed a rupture of the obstructed loop and a general peritonitis. Undoubtedly the obstruction of the intestine played an important part in the fatality of the animals.

TABLE III.—CONTROL SERIES

The average length of life of fourteen dogs with a short isolated high jejunal loop was 2.3 days.

Dog Number	Length of life in dogs
29.....	3
30.....	3
31.....	3
32.....	1
33.....	2
34.....	2
35.....	2
36.....	1
37.....	2
38.....	5
39.....	3
40.....	2
41.....	2
42.....	2

The same type of operation was performed upon an experimental series of fourteen dogs. Five of the dogs received *Bacillus Welchii* antitoxin the morning following operation and nine of them received the antitoxin immediately after operation. An average daily dose of 1.7 centimetres of *Bacillus Welchii* antitoxin per kilogram body weight was administered. The first dose was given intravenously and the rest of them were given intramuscularly. In the experimental series of fourteen dogs, all of which died, the average length of life after operation was 4.6 days. (Table IV.) The isolated loop of intestine was found intact at autopsy in ten of the fourteen dogs. Anaërobic cultures were made from inside the intact isolated loop or from the free fluid in the peritoneal cavity and *Bacillus Welchii* was grown in twelve of the fourteen cultures.

Discussion.—Although there is some disagreement among clinical and experimental investigators regarding the exact nature, mode of formation and action of toxic substances concerned with ileus and intestinal obstruction, it is our belief that anaërobic, as well as aërobic, bacteria play a rôle in the production of the toxæmia found in the two conditions. This belief is substantiated by the fact that life was prolonged in the experimental series of dogs having acute general peritonitis and acute intestinal obstruction by the

BACILLUS WELCHII ANTITOXIN IN PERITONITIS

use of *Bacillus Welchii* antitoxin. The average prolongation of life in the group of animals suffering with general peritonitis that were treated with antitoxin over the control group that did not receive treatment is not long. However, the results obtained in the second group of experiments are more suggestive of a therapeutic efficacy for *Bacillus Welchii* antitoxin in the treat-

TABLE IV.—EXPERIMENTAL SERIES

The average length of life of fourteen dogs having an experimentally produced intestinal obstruction, and which were treated with *Bacillus Welchii* antitoxin, was 4.6 days

Dog No.	Days of life after operation	Autopsy findings	Culture from loop	Antitoxin administered
43.....	2	Loop not ruptured Free fluid in abdomen	B. Welchii	Day following operation
44.....	2	Loop not ruptured Free fluid in abdomen	B. Welchii	Day following operation
45.....	3	Loop not ruptured Free fluid in abdomen	B. Welchii	Day following operation
46.....	3	Loop not ruptured Free fluid in abdomen	B. Welchii	Day following operation
47.....	3	Loop not ruptured Free fluid in abdomen	B. Welchii	Day following operation
48.....	4	Loop not ruptured Free fluid in abdomen	B. Welchii	Day of operation
49.....	6	Loop ruptured General peritonitis	Negative for B. Welchii	Day of operation
50.....	7	Loop not ruptured General peritonitis	B. Welchii	Day of operation
51.....	5	Loop not ruptured General peritonitis	B. Welchii	Day of operation
52.....	7	Loop not ruptured General peritonitis	Negative for B. Welchii	Day of operation
53.....	4	Loop ruptured General peritonitis	B. Welchii	Day of operation
54.....	6	Loop not ruptured General peritonitis	B. Welchii	Day of operation
55.....	5	Loop ruptured General peritonitis	B. Welchii	Day of operation
56.....	8	Loop ruptured General peritonitis	B. Welchii	Day of operation

ment of acute intestinal obstruction. The average duration of life of 2.3 days in this control series was increased by the early administration of antitoxin to 4.6 days in the experimental series. It may be significant that in the group with intestinal obstruction where *Bacillus Welchii* antitoxin was most efficacious that *Bacilli Welchii* were most frequently recovered from cultures made

from the loops of intestine. Definite prolongation of life in this series began when the time of injection of the antitoxin was changed from the day following the operation to the day of operation.

CONCLUSION

It is suggested by our experimental work and by the previous work of Williams that the medical profession is warranted in making a further clinical trial of *Bacillus Welchii* antitoxin as an adjuvant in the treatment of acute general peritonitis and acute intestinal obstruction. The early and adequate administration of the antitoxin should supplement, in addition to surgical intervention, other well established methods of treatment of these two diseases, such as lavage of the patient, the copious administration of saline and dextrose solutions to combat hypochloræmia, starvation and dehydration.†

There has also come to our attention an unpublished article by Owings and McIntosh on "Perfringens Antitoxin and Experimental Intestinal Obstruction." They have concluded (1) that the life of dogs with high intestinal obstruction is not prolonged by the use of bacillus perfringens antitoxin; (2) that neutralization of the toxic substance contained in a closed loop is not affected by *Bacillus perfringens* antitoxin either *in vitro* or *in vivo*; (3) that a minimal lethal dose of loop toxin is fatal to dogs immunized to the toxin of *Bacillus Welchii*.

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- ¹ Williams, B. W.: The Importance of Toxæmia Due to Anaerobic Organisms in Intestinal Obstruction and Peritonitis. Brit. Journal of Surgery, vol. xiv, p. 295, 1927.
- ² Bower, G. O., and Clark, Jefferson: *Bacillus Welchii* (Perfringens) Antitoxin—Its Therapeutic Values. A Preliminary Report Based on the Treatment of Twenty-five Cases. Am. Journ. Med. Sc., July, vol. clxxvi, p. 97, 1928.

† Since the completion of this article there has been published an article by J. J. Morton and S. T. Stabins (Relation of *Bacillus Welchii* Antitoxin to the Toxæmia of Intestinal Obstruction, Arch. of Surgery, volume xvii, p. 860, 1928), in which the authors report experimental evidence that the antitoxin of *Bacillus Welchii* has a specific action in the relief of intestinal obstruction in dogs.

THE RÔLE OF THE BACILLUS WELCHII IN ACUTE INTESTINAL OBSTRUCTION

WITH LIGATION OF THE VEINS TO THE OBSTRUCTED LOOP

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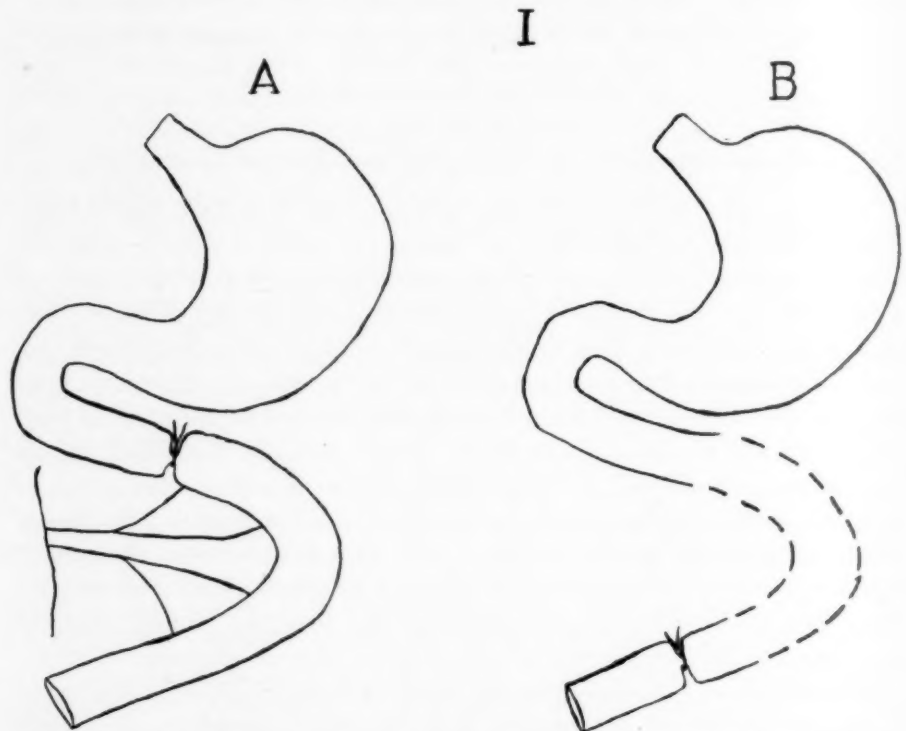
FROM THE DEPARTMENTS OF SURGERY AND PATHOLOGY OF THE MASSACHUSETTS GENERAL HOSPITAL

Introduction.—In 1926 Williams¹ advanced the hypothesis that the toxæmia in cases of intestinal obstruction, whether of organic origin or secondary to peritonitis, is due at least in part to the absorption of the toxin of *B. Welchii* from the obstructed bowel. In support of his theory he cites certain points of similarity between the clinical pictures of intestinal obstruction and of gas bacillus infection, and the fact that he finds *B. Welchii* in large numbers in the contents of the obstructed intestine and in the vomitus from these cases. On the basis of this theory, he gave *B. Welchii* antitoxin to two heterogeneous groups of patients suffering from intestinal obstruction or peritonitis, with an apparently favorable effect upon the course of the disease and with a lowering of the mortality rate. Bower and Clark² in a recent article report a series of twenty-five cases of intestinal obstruction or peritonitis treated with *B. Welchii* antitoxin, and they also consider that its administration favorably influenced the course of the two diseases.

The experiments presented in this report were carried out in an attempt to obtain more definite information upon the importance of the *B. Welchii* as the cause of the symptoms accompanying intestinal obstruction. In these experiments cats were used as the laboratory animal. Studies were made on the course of events during the survival period following the production of intestinal obstruction. All the animals were autopsied, and bacteriological studies were carried out. The toxicity of different strains of *B. Welchii* isolated from the obstructed loops was tested; the susceptibility of the cat to *B. Welchii* was determined; and finally the effects of administering *B. Welchii* antitoxin were studied.

Types of Intestinal Obstruction.—It is essential to realize that the subject of intestinal obstruction is a broad one and that different types of obstruction produce quite different results, as regards both the clinical course and the pathological picture. In general, three main types of obstruction that are quite distinctive have been used in experimental work upon the problem of acute intestinal obstruction (Figs. I, II or III); first, simple blockage of the bowel high in the gastro-intestinal tract; second, closure of a loop of bowel (with or without reestablishment of the continuity of the gastro-intestinal

tract by anastomosis); and, third, obstruction of a loop complicated by gross interference with the venous return from the bowel. It has recently been shown^{3, 4, 5, 6} that it is questionable whether the first type of obstruction causes any true toxæmia, since the symptoms may all be attributed to the great loss of water and electrolytes in the vomitus*; it is extremely unlikely,



FIGS. I, II and III show in diagrammatic form the main types of acute intestinal obstruction most frequently employed in experimental work. There are, of course, many minor modifications of technic. I.—Simple blockage: *A*, high in the intestinal tract; *B*, in the lower portion of the ileum. Type *A* is characterized by profuse vomiting which results in severe dehydration due to the loss of water and of the electrolytes, sodium and chloride. It is questionable whether with this type of obstruction there is any true toxæmia. Type *B* is not used very frequently. Animals with this form of obstruction have a much longer survival period; vomiting is not likely to occur so soon or to be so profuse. Since kinking of distended coils of the small intestine prevents free drainage back into the stomach, a series of semi-isolated loops may result and this type of obstruction thus tends to merge with the second major type described in Fig. II.

therefore, that the *B. Welchii* could play any rôle in this type of obstruction. In the other two types it seems most likely that a true toxæmia does occur, and that the *B. Welchii* might, therefore, be an etiological factor.

For the purposes of this study, three points led us to select the third type of obstruction—namely, a closed loop of bowel with the veins leading to the obstructed segment ligated. In the first place, as shown by Murphy and Vincent,⁸ this type of obstruction is the most rapidly fatal and thus is presumably accompanied by the most severe toxæmia; in the second place,

* It is assumed that the obstruction is at such a high level that free drainage back into the stomach occurs. As pointed out by Hartwell and Hoguet,⁷ the stomach should be kept empty and not allowed to dilate.

BACILLUS WELCHII IN INTESTINAL OBSTRUCTION

since the animals live such a short time, little fluid and sodium or chloride ions can be lost in the vomitus, and their deficiency may therefore be ruled out as a cause of symptoms; in the third place, as shown by McIver, Redfield and Benedict,⁹ excellent anaërobic conditions obtain following the ligation of the veins to the intestines. It seemed reasonable, therefore, to consider that if the *B. Welchii* played a rôle in the pathology of any form of acute intestinal obstruction, they would be most active in this type which is so severe and which furnishes such ideal conditions for their multiplication.

Method of Producing Obstruction.—Cats were used in all of these

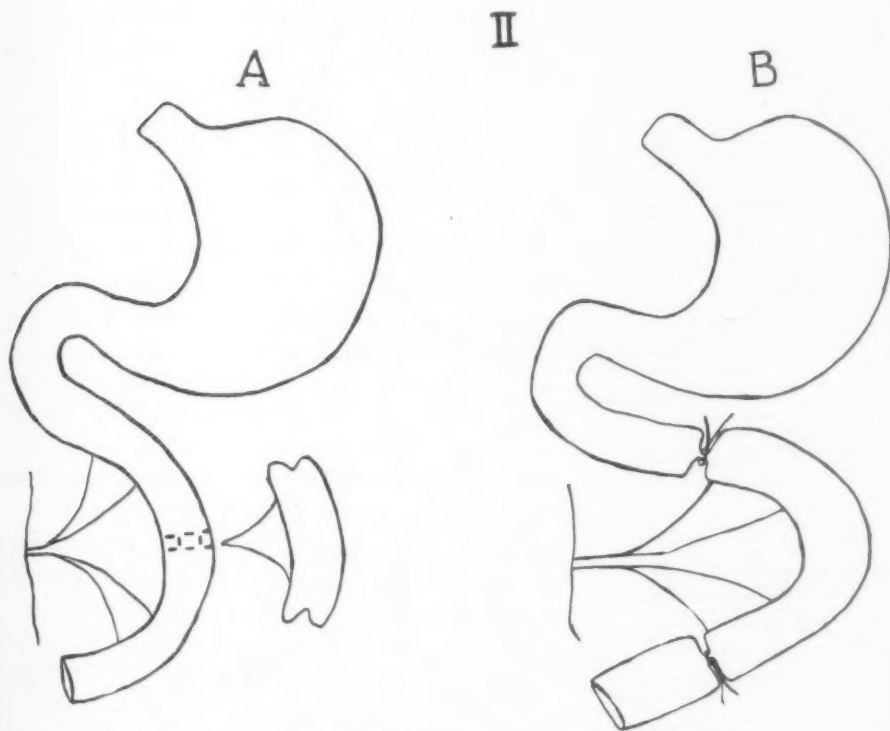


FIG. II.—An isolated loop: A, with reestablishment of the continuity of the intestinal tract; B, without reestablishment of continuity. These isolated loops are usually constructed in the upper portion of the small intestine. Serious symptoms develop early. The amount of dehydration and loss of chlorides depends upon the amount of vomiting and the length of the survival period. Usually the animals do not survive long enough for the changes in the body fluids to become important.

experiments, the operations being carried out under full ether or chloralose anaesthesia. The method of producing the obstruction was as follows: after anaesthetization, the abdomen was opened; a loop of intestine about thirty centimetres distant from the pylorus was selected and the lumen obstructed by a ligature tied around the bowel; at a point about twenty centimetres distal to this, a second ligature was tied around the bowel; the veins leading to the obstructed loop were then ligated with fine silk, great care being taken not to include arteries, nerves or lymphatics. This preparation is similar to that used by Murphy and Vincent⁸ and resembles in certain respects that of

Foster and Hausler;¹⁰ many of the observations given below have been reported by the above authors, but we have repeated certain of their experi-

ments for the sake of completeness.

III

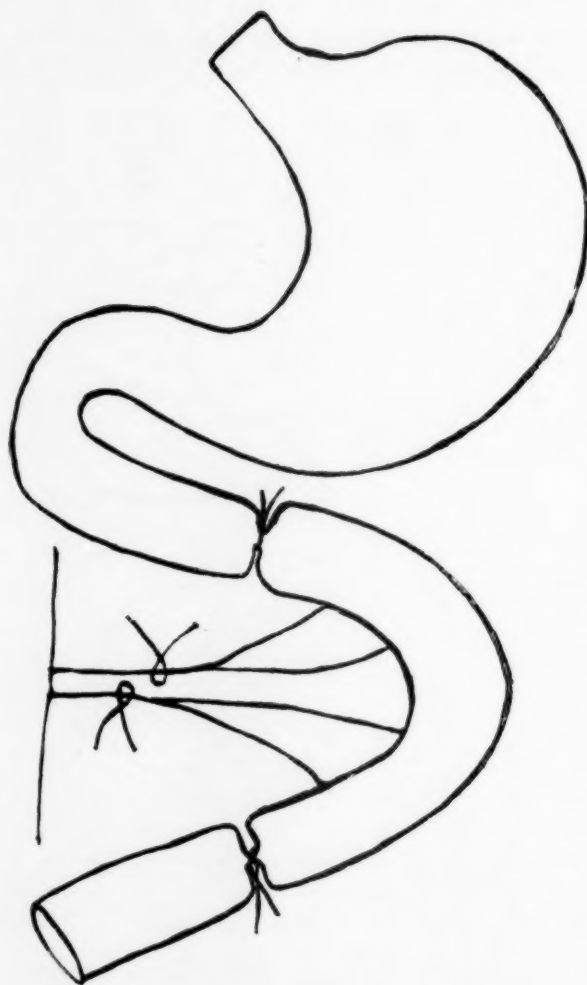


FIG. III.—An isolated loop with ligation of its veins. It is this type of obstruction which is employed in the experiments described in this paper. As pointed out by Murphy and Vincent, this is the most serious and fulminating of the different types. Its clinical counterpart is found in cases of intussusception, volvulus, et cetera. Here, again, the dehydration and loss of chlorides are not of importance. (See Table I.)

Results of Obstruction. Course of Events during Survival Period.

—The survival period of the cats with this type of obstruction was usually between eighteen and thirty-two hours. The animals made a good recovery from the ether anæsthesia and the operation, and showed no striking symptoms during the first twelve hours. A few of them vomited a small amount, but as this was never a prominent symptom their blood chlorides, as might be predicted, were not lowered (Table I), and consequently their life could not be appreciably prolonged by the administration of salt solution. Near the end of the survival period, the animals showed increasing apathy and asthenia; there was marked pallor of the buccal mucous membranes; rectal temperature readings were usually below normal, and the muscles showed some loss of tone. In certain instances the white blood cells were greatly increased, while

in others they were normal; the capillary red blood cell count was usually somewhat higher than that taken from the venous blood—in a typical instance the capillary count was 7,000,000, the venous 6,500,000. Near the end of the

BACILLUS WELCHII IN INTESTINAL OBSTRUCTION

period the blood pressure was below normal; the blood volume was determined in one instance by the vital red method and was found to be distinctly low. The clinical picture presented by these animals is characteristic of a profound toxæmia and is consistent with that produced by a *B. Welchii* infection.

TABLE I.

A Intestinal Obstruction with Ligation of the Veins to the Obstructed Loop								B Simple Blockage of the Intestine			C Control
Cat. No.	1	2	4	6	7	9	33	5	5	5	Average of four normal cats
Time post-operative	32 hrs.	22 hrs.	24 hrs.	22 hrs.	18 hrs.	19 hrs.	20 hrs.	At operation	2 days	4 days	
Blood Cls (mgms. per 100 c.c. serum).	632	768	570	649	642	689	673	700	518	482	698

A.—In the type of obstruction used in these experiments, vomiting is a negligible symptom; therefore, as might be predicted, no lowering of the blood chlorides is found.

B.—Here, for the sake of contrast, the lowering of the blood chlorides that occurs in simple high blockage of the intestine, where vomiting is of course profuse, is shown. In this type of obstruction we believe the loss in the vomitus of water and the electrolytes, sodium and chloride, is largely responsible for the death of the animal.

C.—The average figure for the blood chlorides of four normal cats is shown.

Autopsy Findings.—Autopsy was carried out immediately after death on animals dying of obstruction, and was also performed on a number that were sacrificed by ether anæsthesia from seven to twenty-two hours after operation. The typical findings eighteen to twenty-four hours post-operative were as follows. The peritoneal cavity always contained a rather thin, bloody fluid, varying in amount from thirty to sixty cubic centimetres; if allowed to stand this formed a firm clot; smear preparations of the fresh fluid showed numerous red and white blood cells and occasional organisms. There was no purulent peritonitis. The peritoneal surface of the obstructed loop was usually smooth and glistening; occasionally it had lost its lustre and showed a thin coating of fibrin over the surface. The mesentery of the obstructed loop was œdematous; the obstructed veins were dark in color, distended and thrombosed; the lymphatics were beautifully outlined, being distended with red blood cells and with lymph discolored by hæmolysis; the lymph glands draining the loop were also discolored by disintegrated red blood cells. On opening the thoracic cavity the thoracic duct was usually found to contain blood-stained fluid that on smear showed red and white blood cells. The

loop itself was black in color, distended and tense.† The pressure in the loop was high, readings up to fifty-four millimetres of mercury being obtained by inserting a glass cannula connected with a mercury manometer; the content was made up of from thirty to fifty cubic centimetres of thick, bloody exudate and usually two to three cubic centimetres of gas, rarely as much as twenty to thirty cubic centimetres of gas being found. When the exudate was centrifuged, the particulate elements were found to constitute about 40 per cent. of the total volume; smears showed red blood cells, leucocytes and enormous numbers of organisms. Sections of the wall of the loop, fixed in Zenker's solution and stained with Giemsa, showed considerable disintegration of the normal structure, the mucosa in particular having undergone almost complete degeneration; large numbers of organisms were present in the fragments of mucosa and in the degenerated muscle layers.

Cultural Studies.—Cultural studies of the bacterial flora of the obstructed loops in twenty-eight cats gave quite constant results. There was no noteworthy increase of any organisms of the aerobic group; but the numbers of *B. Welchii* were always increased, even to the extent, in one loop, of constituting 82 per cent. by actual count of the vegetative forms present. In no case was there any doubt but that *B. Welchii* was the predominant organism. So far, this confirms the work of Williams, who found an enormous number of *B. Welchii* in the intestinal contents and vomitus of patients with acute intestinal obstruction. Since, however, the *B. Welchii* is found normally in the small intestine of humans and many other animals, the fact that it can be obtained in large numbers from the bowels and at times from the peritoneal cavity of animals with intestinal obstruction by no means

† The course of events after the ligation of the veins was found to be as follows. The color of the loop changed immediately from a light pink to a dusky red, which in turn soon became dark mahogany-red or black. The peritoneal surface remained smooth and glistening. Coincident with the color changes, active movements started up in the obstructed loop; these for the most part took the form of intense tonic contractions of the whole loop or of isolated segments. At times, in addition to these movements, strong waves of peristalsis swept over the loop and in a number of instances definite waves of reverse peristalsis were noted. Vigorous contractions of the loop usually continued for a number of hours.

Distention of the loop occurred within a short time after the obstruction was produced: in certain of the experiments a glass cannula connected with a mercury manometer was inserted into the loop, and after the lapse of a few hours pressure readings as high as fifty-four millimetres of mercury were obtained. If the loop was opened at this time it was found distended by a thick, reddish-colored exudate, composed largely of blood cells and serum which had been poured into the loop as the result of capillary damage caused by high venous pressure and inadequate supply of oxygen.

The above observations were carried out under chloralose anaesthesia in a moist chamber devised and described by Veach.¹¹ This piece of apparatus consists of a copper box large enough to receive a cat extended on an animal board; the bottom of the box contains water warmed by an electric heating coil; the lid is supplied with glass windows for the purpose of observation, and small apertures permit the insertion of thermometer, cannulae, etc.

Dr. Harold Myers assisted in making these observations.

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proves that it is a factor of importance in producing the symptoms of this disease. On a somewhat similar basis it has been considered¹² the etiological agent in pernicious anaemia; the work of Nye,¹³ however, has shown that the increased numbers of this bacillus in the stools of patients with pernicious anaemia are merely secondary to the gastric anacidity which accompanies the disease and that the organism is probably of no etiological significance.

In a number of instances the cultures of the peritoneal exudate also showed *B. Welchii*. We were also able to demonstrate this organism in several anaërobic blood cultures and once from the lymph of the thoracic duct. There seemed no doubt of the fact that its presence in the blood, lymph and peritoneal exudate was merely a post-mortem invasion of these fluids or an ante-mortem phenomenon in a moribund animal.

Toxicity of Cultures.—It is well known that different strains of *B. Welchii* show marked variations in their ability to produce toxin, and the following studies were carried out to determine the exact extent of these variations in the organisms isolated from the obstructed loop. Fourteen strains were used in an endeavor to determine their toxicity. Each strain was grown in cooked meat broth of Ph. 7.5. After twenty-four hours' incubation, the cultures were removed from the incubator and at once placed in a refrigerator at 4° C. Filtration through Berkefeld-N candles was carried out at this temperature, in the effort to obtain a toxic filtrate. This filtrate was injected intraperitoneally into mice.

Eight of the fourteen strains were entirely devoid of demonstrable toxicity for these mice, in volumes which could be mechanically tolerated by them. Of the six strains developing toxin, two produced a filtrate of which 0.4 cubic centimetres was the lethal dose for a twenty-gram mouse. This toxicity remained fairly constant after six cultural generations, and compared favorably with that elaborated by a strong toxin-producing stock strain which was invariably fatal to mice in doses of 0.3 cubic centimetres and occasionally 0.25 cubic centimetres. The other strains produced toxin lethal to mice in doses of 0.6, 0.8, and 1.4 cubic centimetres, respectively.

It is not surprising to find such a large number of avirulent strains, and it seems from our observation of clinical cases to be particularly characteristic of the strains of *B. Welchii* isolated from the faeces and from wounds of the perineum and adjacent localities where the organisms produce little or no toxin and cause no clinical symptoms of infection.

Susceptibility of the Cat to B. Welchii Toxin.—It is well known that different species of animals show considerable variation in their susceptibility to the toxin of *B. Welchii*. In the literature we could find no work showing the sensitiveness of the cat to this toxin, and in order to obtain data on this point the following experiments were carried out.

A virulent stock strain of *B. Welchii* was grown for twenty-four hours on cooked meat media; the culture was filtered, and 0.3 cubic centimetres of the filtrate was found sufficient to kill a twenty-gram mouse in eighteen

hours. A cat weighing 1.2 kilograms was selected, and the filtrate containing the toxin was injected into the thigh muscles in doses of 4 cubic centimetres and 10 cubic centimetres on two successive days. The animal showed no ill effect from these massive doses of toxin. Six days later a third dose of 12.5 cubic centimetres of toxin was administered, without producing symptoms.

In a second series of experiments, cats weighing about 3 kilograms were etherized and the femoral artery connected with a mercury manometer. The femoral vein on the opposite side was then cannulized and the *B. Welchii* toxin, prepared as described above, was injected in doses of from one to eight cubic centimetres. A fall in blood pressure varying from thirty millimetres to sixty millimetres of mercury occurred, the pressure promptly returning to normal in the course of a few minutes. It was suspected that this transient fall in blood pressure was due not to the *B. Welchii* toxin but to the meat extractives contained in the broth. This was found to be the case, for when sterile cooked-meat broth was given, a fall in blood pressure was noted similar to that obtained with the broth which did contain the toxin. Blood pressure readings on the animals which had received the toxin were carried out for a number of hours. The pressure was well maintained and the animals appeared to suffer no ill effects from the toxin they received.

It would appear from these experiments that the cat is at least relatively immune to the toxin of *B. Welchii*.‡

Results of Administration of B. Welchii Antitoxin.—If the *B. Welchii* played a rôle of importance in causing the death of animals with the type of

‡ Although the above studies appeared to show conclusively that the cat is relatively immune to the toxin of *B. Welchii*, it seemed worthwhile, in order to obtain additional evidence as to whether the *B. Welchii* were responsible for the toxæmia, to supplement these experiments by intravenous injections into normal cats of the peritoneal exudate and loop contents of animals dying of the obstruction.

Eighteen to twenty-four hours after the production of the obstruction the animals were etherized (in the great majority of cases the animals were moribund at this time), the abdominal cavity opened, the peritoneal exudate drawn off, and the contents of the obstructed loop obtained. A normal cat was now etherized and the femoral artery connected with a kymograph for recording blood pressure readings. The femoral vein was then exposed and a cannula inserted. Through this cannula the following materials, obtained from the animal with intestinal obstruction, were injected and the effect on the blood pressure noted. The first injection was of peritoneal fluid; the second, the contents of the obstructed loop. The third type of material injected consisted of the following fractions of the loop contents: (a) the sediment resulting from high speed centrifugation carried on for one hour; (b) the supernatant fluid; (c) the Berkefeld filtrate. The fourth type of material injected was a "dialysate" of the loop obtained by removing the obstructed loop from the animal, suspending it in physiological salt solution and placing it in the incubator for two hours. The results of the injections were as follows.

The peritoneal fluid was injected in four experiments in amounts from one cubic centimetre to twenty-five cubic centimetres. In only one instance was there a slight fall in blood pressure of the recipient. This fluid may thus be considered essentially non-toxic.

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obstruction under consideration, it would seem that life might be prolonged by the administration of antitoxin. This was carried out on five cats, but we could not find that life was at all prolonged by its use, except possibly in one instance. The procedure was as follows. Under ether anaesthesia the obstruction was produced as in the other experiments. Just before closing the peritoneal cavity, forty cubic centimetres of the antitoxin was injected intraperitoneally. The antitoxin injected was the *perfringens* antitoxin (double strength) manufactured by H. K. Mulford Company. The amount injected is stated to contain eighty units; one unit is sufficient to neutralize 1,000 MLD of Welch bacillus toxin; "MLD" is the minimum lethal dose of toxin that will kill a 300-gram pigeon. The dose of antitoxin recommended for humans is about forty cubic centimetres to eighty cubic centimetres; so it is evident that the amount used in the present experiments should have been adequate. This antitoxin should give protection against both the true toxin and the haemolysm produced by the *B. Welchii*, but would have no effect on the non-antigenic false toxin described by Kojima¹⁴ and others.

The animals were operated upon in the afternoon. The following morning a second injection of forty cubic centimetres of the antitoxin was made intramuscularly. This was not done in the case of two of the animals that were obviously moribund the morning following operation. The animals lived twenty-nine, eighteen and one-half, twenty-two, twenty-four and fifty-one hours, respectively. These times represent the usual length of life in the untreated animals, with the exception of the animal last mentioned, where the survival period was fifty-one hours. It was not noticed in any

The crude loop contents were found to be highly toxic, as shown by a profound fall in blood pressure; in certain experiments, 0.3 cubic centimetres were found sufficient to cause the death of the recipient. As would be expected, there was some variation in its toxicity; in one or two instances it was relatively low.

The sediment obtained by centrifugation was highly toxic. The supernatant fluid varied considerably in toxicity, at times producing a fall in blood pressure but at other times producing none, even though both the crude loop contents and the sediment from the same animal were very toxic. In other words, it would appear that for the most part the toxicity of the loop contents depends on the particulate matter. Our findings in this respect are in accordance with those of Murphy and Vincent.⁸

Because of the large amount of particulate matter and the viscosity of the fluid, it is difficult to obtain a satisfactory Berkefeld filtration. Our technic was as follows: The crude loop contents were placed in test tubes containing a few cubic centimetres of 2 per cent. sodium citrate, to prevent clotting, and equal volumes of salt solution were added; this material was then filtered through coarse filter paper and the filtrate was passed through a medium Berkefeld filter. The resulting filtrate was found to have no depressor effect on blood pressure.

The "dialysate" was found to have a decided depressor effect. Its toxicity was not destroyed by boiling for five minutes; and since the toxin produced by *B. Welchii* is destroyed by heat, it would seem that whether it were bacterial in origin or whether it arose from the split protein products of the degenerating intestinal wall, at least the *B. Welchii* played no rôle in its production.

of the other animals that the administration of the antitoxin favorably influenced the course of the disease in any way. It might be urged that since the obstruction was not relieved in this series of animals before the administration of antitoxin, it would not be expected to save the life of the animals. This is admitted; but it does seem reasonable to suppose that if the *B. Welchii* toxin were playing the dominant rôle as the cause of death, the lives of more of these animals might have been appreciably prolonged by the administration of antitoxin in such large quantities.

Discussion.—It seems to be universally agreed that intestinal obstruction produced by isolating an intestinal loop and ligating its veins is characterized by a high degree of toxæmia. The cause of this toxæmia has long been a controversial point, the two principal theories being, first, that it results from bacterial action; and, second, that it is due to the split protein products of the degenerating intestinal wall. The present study is not concerned with the cause of toxæmia, except in so far as *B. Welchii* does or does not play a rôle.

In view of our studies it is unquestionable that the *B. Welchii* are present in enormous numbers in the obstructed loop. All our attempts, however, to find positive evidence that they play a rôle in causing the symptoms of the disease have been unsuccessful: the experimental animal (the cat) rapidly developed a severe toxæmia following the obstruction of the loop and yet was relatively immune to the *B. Welchii* toxin; the organisms cultured from the obstructed loop consisted largely of avirulent or relatively avirulent strains; and, finally, massive doses of *B. Welchii* antitoxin were without any appreciable effects in four out of the five instances in which it was administered. On the clinical side, Williams,¹ and Bower and Clark² have felt that improvement did follow the use of the antitoxin. Before this opinion can be established, however, it will be necessary to select two series of cases with comparable types of intestinal obstruction, giving antitoxin to one series only and otherwise treating them by similar methods. The virulence of the strains of *B. Welchii* that are isolated should also be carefully studied, for the mere presence of the organism unless it is virulent means little or nothing.

SUMMARY

1. The type of obstruction used in these experiments was a closed loop of intestine with its veins ligated; the cat was used as the experimental animal.
2. The *B. Welchii* were found in enormous numbers in the obstructed loop. For the most part these consisted of avirulent or relatively avirulent strains.
3. The cat is relatively immune to *B. Welchii* toxin, although readily succumbing to the toxæmia of the type of obstruction here considered.
4. We were unable to demonstrate that the administration of *B. Welchii* antitoxin prolonged the life of the animals.

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CONCLUSION

In the type of obstruction under consideration, and with the experimental animal used in these studies, the *B. Welchii*, although found in enormous numbers in the obstructed loop, did not play an important rôle in the production of the fulminating toxæmia. There is evidently here some other and more important factor at work. Caution must thus be used in accepting the importance of *B. Welchii* as an agent in the types of intestinal obstruction in humans characterized by a toxæmia, and the use of the *B. Welchii* anti-toxin in the treatment of such cases must be considered still in the experimental stage.

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SOME CLINICAL FINDINGS IN SUBTOTAL GASTRECTOMY*

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SUBTOTAL gastrectomy is obviously an indefinite term. It has come to be associated, however, with the removal of at least one-third of the stomach. Since Billroth's first successful pylorotomy in 1881, all the possibilities of resection of the stomach and anastomosis with the duodenum and jejunum have been developed to the limit of technical ingenuity. Until a few years ago subtotal gastrectomy was an operation reserved for operable or suspected malignancy and a few unusual or extensive gastric ulcers, and gastroenterostomy was the operation of choice for ulceration of the stomach or duodenum.

Two years ago in this Academy John N. T. Finney¹ delivered an address which reviewed the forty-five-year period since Billroth's success, and in this paper he discussed at length all the various theories as to etiology and treatment of gastric and duodenal ulcer, and the various types of operative relief with the advantages and disadvantages of each. I cannot do better than to refer you to this masterly work, as tonight I wish to confine myself to the findings, from the functional and physiological viewpoint, of subtotal gastrectomy as encountered on a general surgical service. This operation until the last decade was simply a mechanical method of removing a lesion benign or malignant, but since the war period the surgeons of Austria and Germany, particularly von Haberer² and Finsterer,³ have used it as a means of altering the physiology of gastric secretion, the removal of the lesion being a somewhat minor consideration.

It is generally conceded that although the acid-forming cells are mostly in the fundus, hydrochloric acid is not produced in quantity without an impulse arising from the pyloric third of the stomach. Irrespective of what factor is accepted as being primary in ulcer formation, hydrochloric acid is rather widely credited with being a source of irritation, that is, an obstacle to healing and a cause of recurrence. The continental surgeons have proceeded on this basis and claim that a subtotal gastrectomy with removal of at least one-third of the stomach is effectual in producing achlorhydria, or at least a marked diminution of hydrochloric acid with the dual result of removal of the ulcer-bearing area and the prevention of recurrence.

Surgeons in this country have been somewhat lukewarm in adopting subtotal gastrectomy as the operation of choice in gastric ulcer, and almost unanimous in rejecting it as routine treatment for duodenal ulcers. The Mount Sinai staff of this city is a notable exception. This marked division of opinion between careful and conscientious surgeons is of course temporary.

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Post-operative results followed for a long period will determine the issue, for theoretical objections will naturally fade away before actual statistical proof.

Von Haberer and Finsterer have been publishing their results since 1922 and apparently demonstrated a low mortality and a high percentage of cures, but their publications do not include the statistical details that carry conviction. Dr. Henry Louria ⁴ recently published the results of a year's attendance at von Haberer's clinic, with a study of the follow-up system and the results covering the period from January 1, 1925, to January 1, 1927. There were 197 cases followed out of a total of 257. A letter was considered a successful follow-up. Out of a total of eighty-one gastric ulcers there were replies from fifty-four. Gastric secretion was determined one half hour after intake of tea and a roll, but no figures are given as to post-operative findings. As you know von Haberer removes from one-half to two-thirds of the stomach and reestablishes the lumen by a gastric-duodenostomy, end to side. This is also Finney's method.

This careful study by Louria indicated that the follow-up system in this very large clinic is inadequate as a basis for convincing statistics.

Let me review briefly the arguments for and against this operative procedure. Conservatives complain that the operation is too mutilating; that the mortality is too high; that the ultimate physiological effect is not known; that achlorhydria may lead to pernicious anæmia; that the essential cause of the ulcer is not being attacked; that according to Balfour ⁵ marginal ulcer not infrequently occurs even after this operation, and, finally, that gastro-enterostomy is a satisfactory method of surgical relief in the great majority of cases. The radicals claim that the operation is practical and of low mortality; that the physiological results are good; that not only hydrochloric acid, but the ulcer-bearing area is removed; that the possibility of malignancy is lessened; that anæmia does not occur; that marginal ulcers are very rare, and that gastro-enterostomy is a failure as a method of treating gastric ulcer and an inadequate method of treating duodenal ulcer.

It must be admitted that the majority of clinics in this country have published very optimistic reports on the results of gastro-enterostomy where these reports have been based in many cases on even more inadequate follow-up systems than those abroad. This is particularly true where cases have been followed for only one or two years. However, no matter which method of reasoning appeals to us, we all encounter problems, exclusive of malignancy, where some form of gastric resection has to be done of necessity, and if the results in these cases are studied they should be of value as coming from an entirely neutral source.

Analysis of All Cases of Subtotal Gastrectomy 1923-1927 for Benign Gastric Ulcer

Hospital—Bellevue; No. 1058. Occupation—machinist, thirty-eight years of age. Date and type of last operation—June 3, 1926; post-colic polya. Date and type of former operation—January 26, 1921; suture of perforated ulcer with gastro-enterostomy. Pre-operative X-ray findings—persistent duodenal ulcer; stoma normal; six hour residue.

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Operative findings—persistent duodenal ulcer; inflamed stoma; attached to transcolon. Post-operative course—smooth; discharge on eighteenth day. Post-operative X-ray—October 22, 1924; partial gastrectomy; normal stoma; rapid emptying. Post-operative gastric analysis—November, 1928, total acidity 17; free hydrochloric acid 0; bile. Final follow-up—gaining weight; occasionally gas; no pain; health good; sticks to diet.

Hospital—Bellevue; No. 1928. Occupation—chauffeur, forty-one years of age. Date and type of last operation—February 10, 1927; antero-colic polya. Date and type of former operation—April 28, 1922; excision of duodenal ulcer; gastro-enterostomy. Pre-operative X-ray findings—February 1, 1927; duodenal ulcer—persistent; adhesions at stoma; stasis in proximal loop of jejunum. Operative findings—apparently healed duodenal ulcer; crater ulcer invading transcolon. Post-operative course—smooth; discharge on twenty-second day. Post-operative X-ray—October 30, 1928, stoma normal; rapid emptying. Pre-operative gastric analysis—January 15, 1922, total acidity 70; free hydrochloric acid 30; February 8, 1927, total acidity 30; free hydrochloric acid 12. Post-operative gastric analysis—November 11, 1928, could not get back test meal. Final follow-up—gaining weight; feels well; herniae.

Hospital—Bellevue; No. 2230. Occupation—chauffeur, forty-two years of age. Date and type of last operation—October 31, 1924; Billroth No. 2. Date and type of former operation—April 20, 1922; excision of duodenal ulcer; gastro-enterostomy. Pre-operative X-ray findings—duodenal ulcer; tender stoma. Operative findings—recurrent duodenal ulcer; jejunal ulcer penetrating colon. Post-operative course—one severe vomiting attack; discharge twenty-fifth day; transfusion. Post-operative X-ray—April 28, 1926, hypersthenic; normal stoma; rapid emptying. Pre-operative gastric analysis—April 18, 1922, total acidity 80; free hydrochloric acid 30. Final follow-up—April 4, 1924, above weight; taxi driver; alcoholic; symptom free; July, 1928, symptom free.

Hospital—Bellevue; No. 3002. Occupation—laborer, fifty-three years of age. Date and type of last operation—January 26, 1923; Billroth No. 2. Date and type of former operation—none. Pre-operative X-ray findings—January 22, 1923; large perforating ulcer of lesser curvature, possibly malignant. Operative findings—massive penetrating lesser curvature ulcer. Post-operative course—discharge seventeenth day; transfusion; vomited twice post-operative. Post-operative X-ray—October 29, 1928, stoma normal in structure and function. Pre-operative gastric analysis—total acidity 45; free hydrochloric acid 25; guaiac lactic. Post-operative gastric analysis—November 25, 1928, total acidity 22; free hydrochloric acid 13. Final follow-up—slightly under weight; occasionally gas.

Hospital—Bellevue; No. 3514. Occupation—invalid, sixty-one years of age. Date and type of last operation—July 27, 1923; sleeve resection. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of lesser curvature, possibly malignant. Operative findings—penetrating ulcer posterior wall of lesser curvature; base in pancreas. Post-operative course—pneumonia; transfusion. Post-operative X-ray—October 28, 1924, deformity pars media; tuberculosis both lungs. Final follow-up—died May 9, 1927, pulmonary tuberculosis.

Hospital—Bellevue; No. 3788. Occupation—barge captain, forty years of age. Date and type of last operation—June 1, 1926; post-colic polya. Date and type of former operation—December 7, 1923; gastro-enterostomy. May 25, 1925; post-colic polya with jejunojejunostomy. Pre-operative X-ray findings—recurrent jejunal ulcer. Operative findings—diffuse acute inflammation of entire stoma and ulcer lower angle. Post-operative course—very stormy; transfusion. Post-operative X-ray—October, 1928, fluoroscopy showed normal stoma. Pre-operative gastric analysis—December 4, 1923, total acidity 95; free hydrochloric acid 80; June 30, 1926, total acidity 65; free hydrochloric acid 25. Post-operative gastric analysis—December, 1928, no gastric residue after test meal. Final follow-up—December, 1928, working as barge captain; no complaints.

Hospital—Bellevue; No. 4270. Occupation—carpenter, fifty years of age. Date and type of operation—June 3, 1924; Billroth No. 2. Date and type of former opera-

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tion—none. Pre-operative X-ray findings—penetrating ulcer, lesser curvature; pars media. Operative findings—large lesser curvature ulcer pars media; many large nodes. Post-operative course—temporary obstruction; re-open; no cause found—tube passed; afterward smooth. Post-operative X-ray—September 28, 1928, rapid emptying; stoma tender. Pre-operative gastric analysis—September 28, 1920, total acidity 60; free hydrochloric acid 40. Post-operative gastric analysis—November 11, 1928, total acidity 25; free hydrochloric acid 0. Final follow-up—symptom free; neurotic.

Hospital—Bellevue; No. 4485. Occupation—laborer, forty-two years of age. Date and type of last operation—October 10, 1924; sleeve resection. Date and type of former operation—none. Pre-operative X-ray findings—ulcer lesser curvature pars media. Operative findings—large lesser curvature, penetrating ulcer both walls, anterior and posterior. Post-operative course—infection of hypodermoclysis, otherwise smooth. Final follow-up—May 19, 1925, pain immediately after meals for fifteen minutes; lost.

Hospital—Bellevue; No. 4542. Occupation—chauffeur, thirty-six years of age. Date and type of last operation—November 7, 1924; antero-colic polya. Date and type of former operation—November 3, 1921; suture of acute perforated duodenal ulcer. Pre-operative X-ray findings—ulcer of first part of duodenum with adhesions. Operative findings—healed duodenal ulcer; large indurated ulcer posterior wall lesser curvature, near pylorus. Post-operative course—very smooth; discharge eighteenth day. Post-operative X-ray—October 30, 1928, normal stoma; slight delay in distal jejunum. Post-operative gastric analysis—November 4, 1928, total acidity 5; free hydrochloric acid 0. Final follow-up—ignores diet; works thirteen hours a day; underweight, but symptom free; excessive tobacco.

Hospital—Bellevue; No. 4664. Occupation—housewife, forty-eight years of age. Date and type of last operation—January 16, 1925; post-colic polya with partial closure of stomach. Date and type of former operation—none. Pre-operative X-ray findings—penetrating ulcer lesser curvature pars media; no retention. Operative findings—perforated ulcer lesser curvature; found by exploring gastric lumen. Post-operative course—very smooth; discharge twenty-eighth day. Post-operative X-ray—April 14, 1925, normal stoma. Post-operative gastric analysis—November 4, 1928, amount twenty-five cubic centimetres; total acidity 7; free hydrochloric acid 0. Final follow-up—has some distress after meals.

Hospital—Bellevue; No. 4974. Occupation—laborer, forty-nine years of age. Date and type of last operation—May 21, 1925; post-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—gastric ulcer. Operative findings—double ulcer lesser curvature near pylorus with craters. Post-operative course—smooth; discharge twentieth day. Pre-operative gastric analysis—May 16, 1925, total acidity 30; free hydrochloric acid 20. Final follow-up—April 20, 1927, ignores diet, alcoholic; symptom free.

Hospital—Bellevue; No. 5355. Occupation—clerk, twenty-four years of age. Date and type of last operation—November 6, 1925; Billroth No. 1. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of first part of duodenum. Operative findings—circumferential ulcer just beyond pylorus. Post-operative course—discharge seventeenth day. Post-operative X-ray—June 5, 1928, irregular first part of duodenum; no ulcer. Post-operative gastric analysis—October 18, 1928, total acidity 24; free hydrochloric acid 14. Final follow-up—October 18, 1928, now symptom free; has had occasional after meals' distress; neurotic.

Hospital—St. Vincent's; J. B. Occupation—Waiter, forty-six years of age. Date and type of last operation—November 27, 1925; antero-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—carcinoma of pylorus. Operative findings—very large callous penetrating ulcer of pylorus; accessory pancreatic duct divided. Post-operative course—pancreatic fistula; death in four weeks from progressive malnutrition. Final follow-up—died twenty-five days post-operative; pancreatic fistula.

Hospital—St. Vincent's; M. H. Occupation—housewife, fifty-two years of age.

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Date and type of last operation—December 6, 1925; antero-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—carcinoma of pylorus with obstruction. Operative findings—apparently a localized linitis plastica of pylorus portion. Post-operative course—very smooth. Post-operative gastric analysis—October, 1928, only a few cubic centimetres returned on lavage in one-half hour after meal. Final follow-up—October, 1928, gaining weight; is eating everything; moderately alcoholic.

Hospital—Bellevue; No. 6432. Occupation—laborer, forty-one years of age. Date and type of last operation—May 24, 1927; antero-colic polya. Date and type of former operation—May, 1918; suture of acute perforated gastric ulcer. Pre-operative X-ray findings—ulcer lesser curvature about junction of para pylorus and para media. Operative findings—lesser curvature para media, penetrating ulcer covered with omentum and liver; many adhesions from old peritonitis. Post-operative course—(illustration) ulcer; wound infection; discharge thirty-third day. Pre-operative gastric analysis—total acidity 70; free hydrochloric acid 60. Final follow-up—October, 1928, ignores diet; alcoholic; no gastro-intestinal complaints.

Hospital—Bellevue; No. 6666. Occupation—fishmonger, thirty-nine years of age. Date and type of last operation—November 4, 1927; post-colic polya. Date and type of former operation—none. Pre-operative X-ray findings—ulcer of lesser curvature. Operative findings—posterior wall para media penetrating ulcer, deep crater. Post-operative course—thirty-six hours shock, then very smooth; discharge twentieth day. Post-operative X-ray—October, 1928, mobility excellent; rapid evacuation; no deformity of stoma or jejunum. Pre-operative gastric analysis—total acidity 78; free hydrochloric acid 51. Post-operative gastric analysis—November, 1928, total acidity 15; free hydrochloric acid 0; bile. Final follow-up—November, 1928, occasionally gas and slight after meals' distress two or three times a week for a time; now O. K.

Hospital—Bellevue; No. 2911. Occupation—carpenter, thirty-three years of age. Date and type of last operation—October 27, 1926; antero-colic polya. Date and type of former operation—December 28, 1922; cholecystectomy; appendicectomy, June 22, 1923; excision and cauterization of gastric ulcer; gastro-enterostomy. Pre-operative X-ray findings—October 22, 1926; penetrating ulcer upper part of lesser curvature; gastro-enterostomy; stoma patent and tender. Operative findings—lesser curvature ulcer; healed pyloric ulcer. Post-operative course—post-operative pneumonia; recovery. Post-operative X-ray—no irregularity at site of anastomosis; stoma function excellent; no six hour residue. Pre-operative gastric analysis—June 13, 1923; total acidity 72; free hydrochloric acid 45; combined hydrochloric acid 12. Final follow-up—no complaints; symptom free; January 4, 1927, July 10, 1928, December 20, 1928.

With this in view I have made a study of all my cases of subtotal gastrectomy performed for a benign ulcerated condition. The series covers a period of eight years and includes seventeen cases, fifteen of which were on the First Surgical Division of Bellevue Hospital and two on the First Surgical Division of St. Vincent's Hospital. In seven cases there had been a previous operation on the stomach and in one case there had been two previous operations. This was the only case in which a marginal ulcer occurred after subtotal gastrectomy. Four had had a previous gastro-enterostomy for gastric ulcer; one had had a previous gastro-enterostomy for chronic ulcer; one had had a previous gastro-enterostomy following closure of acute perforated duodenal ulcer; two had had simple closures of acute perforations, one of duodenal and one of gastric ulcer.

Billroth No. 1 was performed only once and hardly forms the basis of an opinion. Von Haberer and Finney have had their best results with this

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operation. The Billroth No. 2 operation was done three times. Objections to this operation are that it requires more time and that the stoma is not as well placed physiologically as in other methods. Sleeve resection was done twice and in one instance gastric symptoms persisted after operation. Retrocolic polya was done five times. It seems to me less satisfactory than the antero colic polya. The opening in the posterior mesocolon may constrict the stoma or jejunum, and if this is provided for by a jejunojejunostomy we lose the benefit of the duodenal contents in alkalinization of the gastrojejunal stoma.

The anterior polya was done six times and I regard it as the operation of choice for the average surgeon. The theoretical objection has been raised that the jejunum passing in front of the transverse colon may constrict it, but after the pyloric part of the stomach has been removed with the corresponding portion of the gastrocolic omentum the colon falls posteriorly, so that the jejunum can be brought up to the gastric stoma without difficulty. After division of the duodenum and ligation of the greater and lesser omental attachments to the stomach, the jejunum can be sutured to the posterior wall of the stomach with

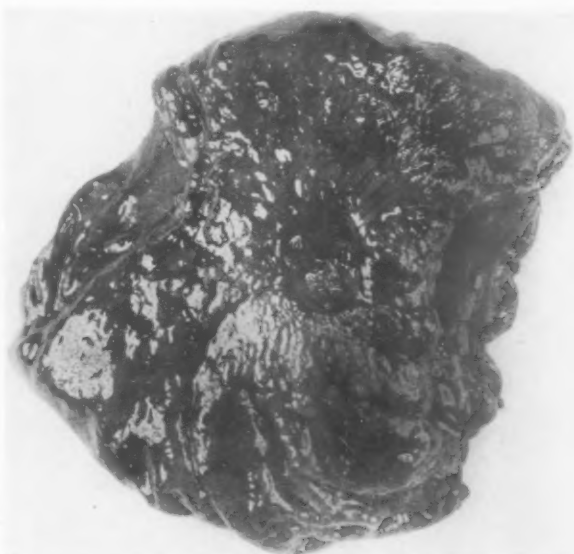


FIG. 1.—Photograph of gastric ulcer removed by sleeve resection.

seromuscular stitches proximal to the line of division before the ulcer-bearing area is removed. This makes the anastomosis much easier and allows a firm approximation at the lesser curvature where difficulty is so often encountered. I do not know who first advocated this procedure, but it was recommended to me by Doctor McCreery.

The pre-operative X-rays throughout the series were remarkably accurate, even to the exact localization of a jejunal ulcer in one case.

Operative Findings.—The lesions found were either primary or secondary. The primary lesions were mainly large crater ulcers of the lesser curvature, of which eight were situated in the pars media, two of them having their bases in the pancreas. There was one instance of what seemed to be a linitis plastica of the pyloric portion of the stomach causing obstruction. There were two instances of double ulcer, one on each side of the pylorus. In all of these penetrating ulcers there was a great deal of surrounding induration and infiltration extending into the omentum or pancreas. There

were seven cases that had had previous operation, five having had a gastro-enterostomy, and two, simple suture of acute perforation. Of the five cases that had had gastro-enterostomy, four showed jejunal ulceration and in three of the four the ulcer was the penetrating type and attached to the posterior wall of the transverse colon in what was obviously an early stage of a jejunocolic fistula. The fourth case of jejunal ulceration had occurred at the stoma of a previous post-colic polya operation. It is not uncommon



FIG. 2.—Gastric ulcer. Polya type of resection.
Good result.

to find multiple ulcers in these recurrent lesions, and one is lead to believe that there is an ulcer-forming type in which a subtotal gastrectomy is particularly indicated, but it is hard to see how that can be recognized at the time of the primary lesion. The dense adhesions found in these secondary operations add greatly to the difficulty and length of time, and this feature is a strong argument in favor of primary resection.

The jejunum involved in the gastro-enterostomy should be resected at once and the lumen restored by an end-to-end anastomosis, the distal portion being used for the antero-colic polya. The Roux method is unsound and led to recurrence in the one instance where it was used. A median epigastric incision being used more than once is prone to herniation.

It is my belief that speed is quite essential in these operations and that the danger from soiling is too slight to justify the time

consumed in elaborate technic. We know that the peritoneum can successfully handle soiling from gastric contents for several hours following perforation without the necessity of drainage after closure. There was no instance in this series of post-operative intraperitoneal infection.

Post-operative Course.—Ether anaesthesia was used throughout, and there was always some degree of post-operative shock, varying from slight to severe. In four cases it was necessary to give a transfusion of from 500 to 1000 cubic centimetres. After two of the Billroth No. 2 operations persistent vomiting occurred and this, I think, was due to transient failure on

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FIG. 3.—Gastric ulcer resected by subtotal gastrectomy. Polya method. Good result.



FIG. 4.—Peritoneal aspect of preceding specimen.

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the part of the stomach to use the new stoma. In one instance it was so persistent that obstruction was feared and the wound was re-opened on the fifth day. No obstruction was found, but as a precaution a stomach tube was passed and manipulated through the stoma before closing the abdomen. This procedure was followed by a smooth convalescence. No contraindication for gastric lavage was recognized, hæmorrhage being regarded as an indication. Returns from lavage invariably showed old blood and, I believe, as a rule, there is considerable post-operative oozing, in spite of the great care observed in hæmstasis at the time of operation. Following the first twenty-four to thirty-six hours the convalescence is very uneventful, but during this first period careful nursing is essential.

Post-operative X-ray.—A check up of X-rays at varying intervals after operation was obtained in twelve out of fifteen living cases. A notable fact in the polya operation was the position of the gastric stump and the gastro-jejunal stoma, the stomach being absolutely vertical in position and well over to the left side. In all of the cases there was a very rapid emptying time. The Billroth No. 2 operation showed the persistence of a small pocket beyond the anastomosis.

Gastric Analysis.—The pre-operative gastric analyses were not always obtainable, but the recurrent type in general showed a high acidity. In ten of the fifteen surviving cases recent gastric analyses were obtained, varying from six months to several years post-operative. The Ewald test meal of a roll and a glass of water was given and expressed one-half hour later. In three cases the stomach was apparently empty and no contents could be expressed. Two of these had had an antero-colic polya and one a post-colic polya. In the other seven instances there was either a diminution of or a complete absence of hydrochloric acid. However, although the Ewald test meal is the one used by the von Haberer's clinic, it seems to me we should have some more exact method of determining the physiology of the stomach after subtotal gastrectomy.

Final Results.—Of the seventeen cases comprising this report, fifteen are living and at work. One was last seen about a year after a sleeve resection and has since failed to report. He was then complaining of pain about fifteen minutes after meals. Two others have had occasional attacks of epigastric distress and gas after meals, possibly due to decreased size of the stomach. One has had gastric symptoms which has occurred only after the onset of a tender gall-bladder. The others are entirely free from any complaint and only one has failed to gain weight.

Of the two deaths, one died four years after a sleeve resection from pulmonary tuberculosis, and previous to this had had no post-operative symptoms referable to the gastro-intestinal tract. There was one patient who died as the result of a pancreatic fistula following operation.

HISTORY OF CASE OF OPERATIVE DEATH

At operation the pylorus and first portion of the duodenum were involved in a large indurated mass enfolding the gall-bladder. On separating this from the gall-bladder there

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was found an old perforation about one centimetre in diameter leading into the pyloric end of the stomach. An antero-colic polya operation was performed.

In turning in the proximal end of the divided duodenum under purse-string sutures a very small, white band on the mesial side was divided. Being rather suspicious of this structure, it was probed and found to have a lumen which extended down the body of the pancreas. The common duct was then investigated and found to pass down through the head of the pancreas and into the duodenum, well beyond the area of resection. It was taken for granted that the duct of Wirsung accompanied the common duct into the papilla of Vater, and that the small-sized band was the accessory duct of Santorini entering the duodenum at a very high level. It was firmly ligated with chromic catgut, as there was no possibility of implanting it into the duodenum because of its minute size and because of its position.

The patient made a good recovery from operation, but forty hours later a discharge of clear, syrupy fluid appeared from the upper part of the wound. It was colorless, and a specimen which was sent to the laboratory was diagnosed as pancreatic juice. It became very profuse in amount.

Temperature and pulse remained normal and emaciation and weakness developed to an alarming degree. After two weeks the fluid tended to decrease in amount. Emaciation and weakness steadily increased and he died of malnutrition on the twenty-ninth day.

Examination of the faeces showed no free fat. Blood chemistry showed blood sugar, creatinine and urea normal. Non-protein nitrogen high.

I do not know of any procedure that could have been attempted, post-operatively, to save this patient. The accessory duct, which was divided, occurs in this high position, according to the Dissection Room Records, only once in a hundred and fifty times, and it is exceedingly rare to have it the main pancreatic duct.

CONCLUSIONS

1. After recurrent ulcers of the stomach or duodenum and after marginal or secondary jejunal ulcers, the polya operation offers a reasonably safe and satisfactory method of relief from chronic invalidism.

2. As far as can be determined by X-ray and by the Ewald test meal, subtotal gastrectomy establishes and maintains a very rapid emptying of the stomach with marked diminution or disappearance of free hydrochloric acid in proportion to the amount of stomach removed.

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URETERO-ENTEROVENTRAL FISTULA*

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FROM THE MAYO CLINIC

TO HAVE either a urinary or a faecal fistula is unfortunate, but to have a combination of both, secondary to an infected ectopic kidney which necessitates operation, is almost unique.

Ectopic kidneys are not only relatively uncommon, but when they become diseased are difficult of removal. The condition is caused by arrest of the upward course of the renal anlage, from its original position in the foetal pelvis to its normal resting place in the back. Usually these kidneys become arrested just at the brim of the pelvis or a little above. The true variety derives its vascularization usually from the common iliac vessels, whereas the acquired type, which is occasionally met with, is supplied by an artery which develops from the upper abdominal aorta. Müller's duct does not normally develop until the primitive kidney has reached its final level in the loin; hence it is not difficult to imagine or to find accompanying mal-



FIG. 1.—Injection, by syringe, of brominated lard oil through the fistulous tract demonstrated, under Röntgen-ray, the connection between the patent ureter and the ileum.

formations of the intestinal tract or generative organs arising from Müller's duct in the individual who has a true ectopic kidney. Although such malformations may be single or multiple, they probably are more often absent than not, and when present, symptoms, definite or masked, accompany them in proportion as their functions are disturbed. Not infrequently, symptoms

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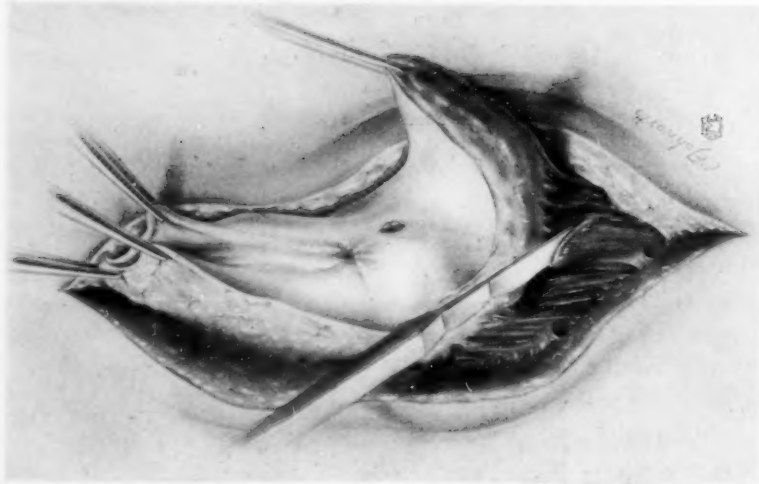


FIG. 3.—Incision around umbilicus and the fistulous tract which is to the left and immediately below it. A block of the abdominal wall down to the muscle is excised, removing not only the umbilicus and the old scar, but beginning dissection of the tract.



FIG. 2.—Connection between the patent ureter and fistulous tract. The tube had been indwelling for eleven months.

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secondary to developmental anomalies of any of the human systems develop slowly and evidence themselves in the middle or latter decades of life. Ectopic kidney is found as a tumefaction in the lower portion of the abdomen, more often, for anatomic reasons, occurring on the left side than on the right. Its distribution as to sex is about equal. The suprarenal glands, because of their independent development, more often than not are found in their normal positions in the back, regardless of the situation of the kidneys.

The case which we present for record is interesting from several stand-



FIG. 4.—The abdomen is opened widely and the tract from the abdominal wall down to the renal pocket is shown. The dense adhesion between the small bowel and the kidney hits a fistulous opening demonstrable by Röntgen-rays.

points. The patient had been operated on elsewhere. An ectopic kidney had been found on the left side and had been partially removed, but with subsequent development of a ventral urinary and faecal fistula. The successful removal of the fistulous tract, as well as of the remainder of the kidney and ureter, with closure of the opening in the intestine, makes the case seem worth while to report.

The patient came to the clinic in October, 1928, and gave the following history: November 16, 1927, while at work as a cook, he suddenly had been taken with severe pain in the left lower quadrant of the abdomen. The pain lasted two and a half hours and was "shooting" in character. He became weak, fainted, and was put to bed. The following day he returned to work. The next day he discovered a "lump" to the left and below the umbilicus. It became larger until November 20, when he went to the hospital where he was given massage and hot packs. Trouble with the bowels was not present at that time. The following is a report from his surgeon:

"This man entered the hospital with a mass over the pubic region. It was not relieved by catheterization. There was no increase in temperature or in pulse. The bladder was completely emptied. Catheterization of the ureter was unsuccessful on the left side. An operation was decided on.

"On opening the abdomen, he was found to have a pelvic kidney, with a pedicle about one-half inch long and what was apparently an enormously dilated pelvis of the ureter, lying in front of the promontory and a little to the right side, closely adherent to the sacropromontory and lower lumbar vertebra. This contained about a pint of pus. The lining was spongy and bled profusely when touched. On account of the bleeding the pus was removed, the cavity packed and left for three weeks. At the end of three

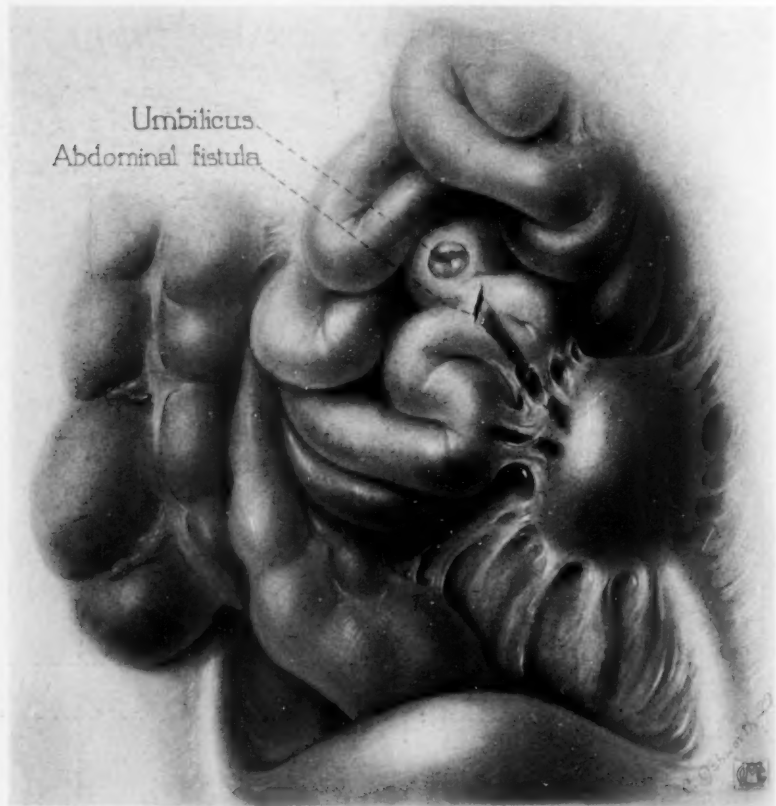


FIG. 5.—Displacement of the sigmoid to the right, its mesenteric attachment being well over to the right side of the pelvis. The ureter and remainder of the kidney, which contains several ounces of pus, are shown, as well as the tract which communicates with a coil of small bowel. The remainder of the kidney is tightly adherent to, and derives its blood supply from, the common iliac vessel.

weeks, the cavity was reopened and all of the sac was removed except that which was attached posteriorly. There was no ureter, on opening, to be found. The kidney was also removed. The wound was closed with a drain left in. This wound remained without healing and with a continuous discharge.

"I was not here for several months and on my return investigated the wound. I found it extended down into the pelvic cavity with a very soft, or no, wall in the pelvis. The discharge, apparently, was urine, as I put argyrol in the bladder and this drained into the wound. On this account I wished to make further investigation which was refused here and the patient decided to go to your place for treatment."

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The rubber tube drain which had been inserted November 22, 1927, and had been removed and reinserted January 21, 1928, was still intact when the patient arrived at the clinic in October, 1928. The patient had not been well since the nephrectomy; pus had drained constantly from the wound. In July, 1928, considerable watery drainage had been present; early in September, urine had begun to drain and had continued to drain until three and a half weeks before admission to the clinic. During September faecal material also had drained from the sinus, off and on.

General examination revealed a rather nervous pale man, five feet nine inches tall, weighing 126 pounds (a loss of twenty-four pounds). Except for the foul, draining sinus, with a rubber tube in a low median-line scar, examination was negative. Masses

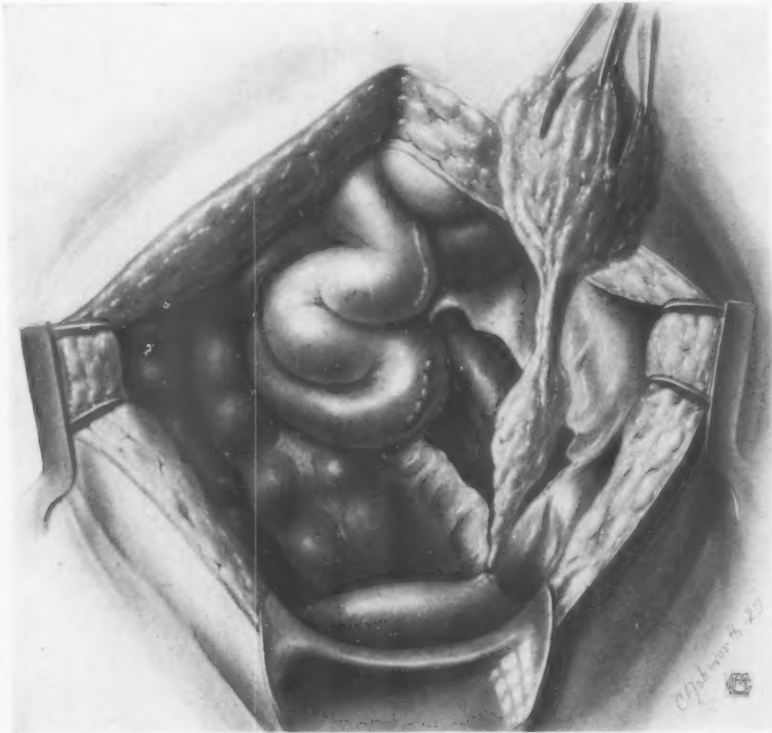


FIG. 6.—The operation is complete here, with the exception of removal of the tract and ureter and the reperitonization, as far as possible, of the raw surface at the brim of the pelvis. The suture line shows where the opening in the small bowel was closed. A ligature is shown on the ureter at its entrance into the bladder.

could not be palpated and the lower portion of the abdomen was only mildly tender. Urinalysis was negative. Examination of the blood revealed hæmoglobin to be 76 per cent.; erythrocytes numbered 4,960,000 and leucocytes 8500. The Wassermann reaction of the blood was negative. The blood urea was twenty-four milligrams in each one hundred cubic centimetres. Röntgen-ray examination of the colon, performed by barium enema, disclosed transposition to the right of the sigmoid and descending colon. A ureterocolic fistula was not visualized. The same report of Röntgen-ray examination was given after a barium meal had been administered by mouth (stasis ray). Röntgen-ray examination after injection by syringe of brominated lard into the fistulous tract revealed patency between the ileum and ureter. (Figs. 1 and 2.) The patient was operated on November 5, 1928.

At operation there was a drainage tract extending from just below the umbilicus into a cavity which communicated with the left ureter. It was evidently from the old

renal cavity. The wall of the cavity was tightly adherent to the common iliac vessels on the left side. About 100 cubic centimetres of thick, creamy pus poured out when an opening was made into the remnant of the renal pelvis. A small opening which connected the cavity with the ileum was found and was closed. The ureter was traced down, was tied near the bladder with silk and was dropped back into the abdominal cavity. The dissection was carried out mostly in the mesentery of the sigmoid. The sigmoid, as found on Röntgen-ray examination, lay on the right side. (Figs. 3 to 6.) The pathologist's report of a section of the tract was: "Inflammatory sinus tract with attached inflammatory ureter."

The patient was dismissed twenty-seven days after the operation with the wound healed. He weighed 121 pounds. The convalescence and the results were very satisfactory.

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EXTENSIVE RESECTIONS OF THE SMALL INTESTINE *

BY ADDISON G. BRENZER, M.D.

OF CHARLOTTE, N. C.

THE term "Extensive" as applied to resections of the small intestine has arbitrarily been accepted to embrace only those lengths, measuring 200 centimetres (6 ft. 7 in.) or more. This measurement is accepted on the basis of clinical records, which prove that resections beyond 200 centimetres may give rise to various metabolic disturbances.

Various authors give the length of the small intestine between fifteen feet, six inches and thirty-one feet, ten inches. The summary of opinion would place the average length at twenty-two and one-half feet. Brenzer found that the small intestine not only varied, within wide limits of length in the dog, but also in man and varied with the height and weight of the individual, usually the larger the individual, that is the taller and fatter, the longer the intestine. Beneke states that for every 100 centimetres (3 ft. 3½ in.) of body length there is 387.5 centimetres (12 ft. 9 in.) of small intestine, and Flint claims that there is a definite ratio between the size of the individual and the epithelial surface of the intestine.

In the work of Evans and Brenzer it was also observed that the intestine measured *in situ*, that is, attached to the mesentery, was much shorter than when measured detached from the mesentery; that a variable of several feet might be gained through stretching the length. Due to the natural variability in length, that due to detachment and stretching, they made their reports more accurately in percentage.

Again, in children, the intestine, though relatively to size longer, is actually shorter than in adults, allowing, length for length, a shorter resection to equal or excel the percentage resected in the adult.

The important question is not so much the extent removed as that left behind, either measured directly, which is frequently difficult or impossible, or estimated by that removed.

RECORDED CASES

Up to June, 1923, PIRIE WATSON, using the tables of all authors to date, collected seventy-three cases, including his own, in a most exhausting search of the literature.

DOERFLOR reports a case six and one-quarter years after removal of 560 centimetres (18 ft. 8 in.) of the small intestine, leaving only twelve centimetres (4 and 4/5 in.) of jejunum and twenty centimetres (8 in.) of terminal ileum, and claims the patient to be in good health, no complaint, takes regular meals, has two stools a day, gets up at 5 A.M. and does his whole work at the age of fifty-eight. He raises the question: "Is the small intestine essential for life?"

SOHN resected the entire jejunum and part of the ileum, 275 centimetres (9 ft.

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2 in.), and reports the case again four and one-half years later as subjectively well and strong, but further examinations of metabolism refused by patient.

SARNOFF resected fifteen feet of the small intestine and did a hysterectomy, recovering the patient after a stormy course and faecal fistula. The patient presented the typical symptoms credited to such extensive resection, namely, thirst, hunger, diarrhoea, loss of weight and sensitive intestines, all of which occurred during the first few weeks of her illness. The patient, six months later, is in good condition; appetite undiminished, has two bowel movements daily instead of being constipated as before operation.

HOFMANN reported two cases, 385 centimetres (12 ft. 6 in.) and 300 centimetres (10 ft.), after five and one-quarter and four years respectively. The former case, a woman, tolerated a resection of twelve feet, six inches of small intestine and caecum, lived three years complaining of dyspepsia; on finding two callous gastric ulcers, the size of a small apple, a posterior gastro-enterostomy was done with recovery; experienced two and one-quarter more years of relative comfort, except for a ravenous appetite and diarrhoea, and died of basilar meningitis (tuberculous). Hofmann failed to find any histological difference between the intestine removed and preserved five and one-quarter years previously and that recovered at autopsy. The latter case, a man, bore a resection of ten feet of the small intestine, continued to complain with symptoms typical of ulcer of the stomach, experienced, likewise, a gastro-enterostomy for ulcer of the stomach and is living after four years and doing fairly well on a restricted diet. Hofmann explains the ulcers, likely due to a retrograde infected embolus, slipped at the time of the resection operations, and quotes Eiselberg, that ulcers of the stomach and duodenum are not infrequent after massive procedures in the abdomen.

JACKSON resected 142 centimetres (4 ft. 8 in.) and left twelve inches of the ileum in a child two years old. This resection he calculated to be two-fifths of the entire small intestine and exceeding the arbitrary extensive resection in the average adult. For the first year the bowel movements were almost continuous, but gradually improved for five years and after seven years still has some "stomach trouble" and diarrhoea on account of a ravenous appetite and indiscretions in diet.

PALMER'S case, 327 centimetres (10 ft. 1 in.) resected and about 80-90 centimetres (2 ft. 6 in.) left behind was operated on for so-called "knot formation". This case made an excellent recovery and was used by Tuomikoski for his experiments in metabolism, where he found fats and proteins are poorly utilized but that carbohydrates are well borne. This author stressed the importance of a well-developed colon favoring his nutritional results.

SCHUGT reports, on April 11, 1925, a case of perforation of the uterus with gross injury and extensive resection of a case operated by Professor Dietrich March 30, 1924, when, according to Beneke's estimations, 580 centimetres (19 ft. 4 in.) of the small intestine was removed, likely 95 per cent. of the whole small intestine. By January 26, 1925, she had gained five and one-half pounds over her usual weight and complained only of gas after potatoes and vegetables, and of some weakness.

FLOSDORF resected 200 centimetres (6 ft. 7 in.) of small intestine and reports the case after three years. During the last year there are marked digestive disturbances, loss of weight, and patient is a chronic invalid, getting worse and not expected to live.

BRENIZER.—Mr. W. M., age twenty-one years, entered the hospital November 22, 1927, abdomen distended, painful, vomiting, faecal fistula. He was operated on in another town for puss appendix in December, 1926, and drained. Remained in the hospital for nineteen days and drained for a month and half after leaving the hospital, wound finally healing March 16, 1927, vomited, and had difficulty getting bowels to move. September 1, 1927, reentered same hospital, vomiting and no bowel movements. Was operated on for the second time and loop of bowel opened. Shortly after this operation, wound split open and another loop of bowel came out of wound. Attempt to replace the loop was futile and it was cut off. Remained in hospital forty-two days. Four days

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after leaving, the flow from the intestine stopped and he returned to hospital, when a forceps was put into the wound and spread, on October 16, 1927. This opening continued to drain faecal matter irregularly until November 21, when it stopped again, and since then he has been vomiting and having no bowel movement. Has steadily lost weight, from 168 down to 102 pounds; is pale and weak.

Temperature, 99-4; pulse, 110; respiration, 20; blood pressure, 95/60.

Abdomen: Distended, firm, tympanitic, McBurney scar; right rectus scar; two fistulous openings, from one pus can be pressed from hard mass on left side below navel. Small amount of faecal matter from other.

Operation, November 22, 1927. Excision of old right rectus scar with fistulae, liberation of massive adhesions to abdominal wall and between intestinal loops; considerable pus between loops on lower left side. Intestine severed in several places. Due to several separate segments of severed intestine shredding on liberating, nine and a half feet of ileum was resected, leaving about six feet of ileum and jejunum behind. A lateral anastomosis was done between the ileum and much damaged caecum. Patient, already weak, was very much collapsed from rough handling, and blood ooze, was given 500 cubic centimetres of blood on the table. Picked up markedly.

The after course was surprisingly uneventful. Proctoclysis and liquids for first four days, then semi-soft diet for six days and soft diet for remainder of three weeks in the hospital. The wound scarcely drained at all for five days, the drains were removed and wound healed. At first there were five or six stools a day and two or three stools a day for six weeks. Patient returned for examination in three months, having eaten, after six weeks, practically a full diet. He had gained from 102 to 172 pounds, felt well, and had three stools a day. Urine was negative.

X-ray: Stomach emptied in one and one-half hours; small intestine visible in streaks; colon filled in three hours.

Patient returned November 16, 1928, looking well, feeling strong, doing his work and eating what he wants; is very hungry for his meals; has two stools a day; weighs 168 pounds, his regular weight.

X-ray: Examination one hour after the ingestion of barium meal showed about an 80 per cent. residual in the stomach and the head of the barium column in the ileum. The two hour examination showed about a 40 per cent. residual in the stomach, the barium to be scattered throughout a few loops of small intestine. The loops of the small intestine well filled are few. The head of the barium column is in the ascending colon near the hepatic flexure, the colon distal to this being well filled. The enterostomy stoma is low in the pelvis, consequently cannot be manipulated. The five hour examination showed the stomach to be empty and the barium to be scattered from terminal ileum well down into the descending colon.

Faeces: Normal, no blood, no mucus, no excess of fat and nitrogen. White blood cells 11,000; red blood cells 5,500,000; haemoglobin (Sahli) 95 per cent.

Including my own case the total number of cases published to date, where the resection of the small intestine exceeds 200 centimetres (6 ft. 7 in.) is eighty-three, with seventy-one operative recoveries. The natural tendency has been to report only successful cases where the recovery lasted for several months or years. This accounts for the surprisingly low death rate in the published cases—14.3 per cent. There have been recently deaths reported after two to five and one-half years. The percentage of recovery from operation equals 85.7 per cent. and the percentage of good functional recoveries is 65.5 per cent.

The series includes cases of small intestine resections ranging from that of Flodorf, six feet seven inches, with death from digestive disturbances

and inanition in three years; that of Brenner, seventeen feet nine inches, with death from marasmus in two and a half years; up to that of Schugt, nineteen feet four inches, and that of Doerflor, eighteen feet eight inches, in excellent condition after one year and six and one-quarter years respectively.

We must conclude from the clinical evidence drawn from these cases that the minimum extreme resection may fail in time and the maximum offer excellent results and that there are always possibilities for good or bad between the two extremes.

The ages between eleven months and sixty-five years have been reported but most of the cases occurred between twenty to forty years; and the sex has been fairly equally distributed in these cases where it was mentioned.

Extreme resection of the small intestine is almost always an emergency procedure, in a bad risk case, where the surgeon is caught between the two alternatives of resection or letting the patient die. The morbid condition is mentioned in sixty-four out of the eighty-three cases reported:

Twenty-one cases were strangulated herniæ: 7, variety not stated; 7, inguinal; 2, femoral; 3, umbilical; 2, ventral.

Nine cases were for strangulation from omental and other bands and adhesions.

Eleven cases were for trauma: 3, rupture of mesentery and intestine; 6, rupture of uterus with protrusion of intestine; 2, gangrene after intestinal prolapse through a punctured wound.

Seven cases were for abdominal tumors: 5 of the mesentery, fibroma, myxofibroma, myxosarcoma, sarcoma; 1, ovarian, 1, carcinoma of cæcum, with metastases in mesocolon and mesentery.

Four cases were for multiple strictures (tuberculous).

Three cases for mesenteric thrombosis.

Four cases for volvulus.

Two cases for intussusception.

One case, so-called "knot formation".

One case of gangrene of bowel following appendicitis.

The method of restoring the continuity of the bowel is recorded in forty-four of the eighty-three cases. About 75 per cent. were a lateral anastomosis and 25 per cent. end-to-end (a larger opening and greater security has been sought).

In eight of the cases between 1901 and 1909 the Murphy button was used with success, but the unsuccessful cases, where it was used, are not reported. The part of the intestine resected is mentioned in thirty-four out of the eighty-three cases, the jejunum was included in five of these cases. From a physiological standpoint, resection of the jejunum should cause more digestive disturbances than resection of the ileum, but this fact has not been proven either from the recorded cases, nor the contradictory experiments on animals.

The average of good functional recoveries is 65.5 per cent. (thirty-seven out of fifty-seven cases). Diarrhœa is the most disturbing disorder of metabolism, coupled with a ravenous appetite and therefore a morbid tendency on the part of the patient to break the diet. Almost all authors are agreed that

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foodstuffs are most disturbing in the following order: Fats, proteins, bulk of cellulose material, and carbohydrates. The painstaking experiments of Tuomikoski on Palmer's case (327 cm. resected, 80-90 cm. of jejunum left behind—75 per cent. to 80 per cent. removed) would confirm and establish the fact that fats and proteins are poorly utilized, while carbohydrates are well borne. This author, as well as several others, have been impressed with the idea that a well-developed colon favored their nutritional results. This is undoubtedly true, the longer, the less irritable the colon, the longer the delay in the colon, favoring a longer continued digestion of material squirted into the colon and its more complete absorption. Where X-ray reports after resection are recorded, as in my own case, the emptying of stomach and small intestine, and consequently the colon, is at first very rapid, followed in the course of time, a year or more, by delay in emptying of the stomach and remaining small intestine, as well as delay in the colon. In my own case two months after operation the stomach was completely empty in two hours, the coils of the small intestine could scarcely be pictured, but, after one year, the stomach was not completely emptied up to five hours and the intestinal coils were easily pictured with accumulation in the terminal ileum.

The reports on the urine have been recorded only in a few cases, using an excess of indican and ethereal sulphates to indicate increase in intestinal putrefaction. An excess was commonly found in dogs subjected to extreme resections. In all reports except five the urine has been reported normal. There have been no satisfactory reports on the blood picture and blood chemistry, nor on the metabolic rate.

The combined work of experiments on dogs initiated by Senn in 1892, Trzebiecki in 1894, Monari in 1896, Diliberti-Herbin in 1904, culminated in the work of Evans and Brenizer in 1907, and Flint in 1912. Evans and Brenizer, in 1907, resected one-third to one-half of the combined jejunum and ileum on four animals which recovered. They noted a compensatory hypertrophy localized to the anastomosis. In two animals resections of 76 per cent. and 85 per cent. of the small intestine were followed by recovery, but in three animals resections of 86 to 92 per cent. resulted in death from inanition. In these animals the limit had been exceeded beyond which compensation could be established, and as no hypertrophy was noted at their autopsies, Evans and Brenizer concluded that in animals one-third to one-half of the combined jejunum and ileum can be resected with safety, but that beyond this limit compensation may fail to be established and death from inanition results. This limit of resection with safety corresponds with the arbitrary limit accepted in man, that of 2 metres (6 ft. 7 in.).

Flint in 1912 carried his work on beyond that of Evans and Brenizer, but arrived at about the same limit of resection. He concluded: "Dogs from which about 80 per cent. of the combined ileum and jejunum have been removed or short circuited may live indefinitely after the operation. The first effects of the operation give a profuse diarrhoea and loss of weight, from both of which the animal slowly recovers. At the same time the resec-

tion of a smaller amount, *e.g.*, 65 per cent. of the entire intestine may lead, notwithstanding a ravenous appetite and an unlimited diet, to changes which prevent the dog from recovering its well nourished condition. In these animals the nutrition may be apparently normal, but they are nevertheless so sensitive to dietetic disturbances that a diet or conditions of any severity may introduce a fatal marasmus or enteritis. Flint found that young, growing animals did not stand the operation as well as older dogs. Still, his case of an infant, eleven months old, in whom a resection of 100 centimetres, more than one-third of the entire intestine at this age and equal to the arbitrary limit of 2 metres in the adult, was done made an excellent recovery, although, at first, there were severe digestive disturbances.

Flint's investigations into the metabolism of these animals showed an excess of nitrogen and fat in the faeces as a direct result of diminution, of the absorbing surface of the gut. Profuse diarrhoea invariably occurred after the operation and the animals lost weight, being forced to consume the nitrogen and fat of their own tissues. Gradually, however, the excessive excretion of nitrogen and fats diminished through a restoration of the power of absorption in the remaining gut and the animals return to normal nutrition. They remain, however, susceptible to changes in diet, so that diets rich in proteins, fats or indigestible substances may again produce diarrhoea with excess of nitrogen and fat in the faeces.

Finally, the most important question: Does functional recovery depend on compensatory hypertrophy of the remaining small intestine? According to Flint, there is an increase in the transverse dimensions of the bowel, no increase in the number of villi, but an increase in their size, which equals 400 per cent. increase of surface. The crypts were enlarged in proportion to the enlargement of the villi. The epithelial cells of the hypertrophied villi were increased in size and the goblet cells were numerous. He found this anatomical compensation present and complete, or partial, or absent, with a corresponding recovery or not of the animal. Brenizer and Evans noted a compensatory hypertrophy localized to the anastomosis alone.

The clinical course in man, in many cases, corresponds with these anatomical findings of Flint, although no compensatory hypertrophy has been reported in humans as yet. On the other hand, as already referred to, Hofmann failed to find any histological difference between intestine removed five and one-quarter years previously and that recovered at autopsy. Was this a case where compensatory hypertrophy was incomplete and finally failed?

CONCLUSIONS

1. The arbitrary limit of assured safety, two metres (6 ft. 7 in.), applied to resections of the small intestine, is embraced in the term extensive.
2. Resections up to and beyond the arbitrary limit have become necessary as a life-saving measure and have yielded 85.7 per cent. recoveries from operation and 65.5 per cent. good functional results.

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3. Functional recoveries in man, as in dogs, are likely dependent upon compensatory hypertrophy.

4. Metabolic studies both in animals and man establish a diet rich in carbohydrates, less of proteins, but poor in fats.

In the preparation of this paper, though I have read all references in their original, I have, of a necessity, drawn abundantly on the paper of Pirie Watson, a veritable statistical compilation up to that date, June, 1923, and wish to credit him and thank him for any material or expression I may have borrowed from him.

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THE DIAGNOSIS OF PRIMARY NEOPLASMS OF THE RENAL PELVIS *

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CARCINOMATA comprise approximately 5 per cent. of all renal neoplasms, and while the derivation of extensive malignant new growths of epithelial origin may be impossible to determine, the probabilities are that the majority of them originate from the pelvic mucosa. It would seem improbable, therefore, that the insignificant total of 179 cases collected from the literature by Smith and Gilbert,¹ in 1925, represents the true incidence of intrapelvic tumors. A few cases reported since 1925, including those of Day,² Meltzer,³ and of White and Rich,⁴ may be added, but the total is excessively small when compared with the great frequency of the rather closely related epithelial tumors of the urinary bladder. Approximately one-half of the recorded cases of intrapelvic neoplasm are to be found in the literature of the last twenty years, and a number of the most important papers have appeared very recently. This renewed interest in the subject is attributable, perhaps, to the more precise diagnostic means at our disposal, although few correct pre-operative diagnoses have been reported. Miller and Herbst⁵ are credited with having made, in 1921, the first correct pre-operative diagnosis of a papillary tumor of the renal pelvis. Little effort has been made to differentiate by urography the papillary from the flat, or non-papillary, tumors of the pelvis, although clinical differences are clearly defined. Such clinical differentiation is rarely possible in the case of the non-papillary type of tumor before the disease has advanced to the inoperable stage. This is well illustrated by the case reported herewith, as well as by those described by Kretschmer,⁶ Scholl and Foulds,⁷ Wheeler,⁸ Keynes,⁹ and others. Ewing¹⁰ classifies neoplasms of the renal pelvis as (a) benign papilloma, (b) papillary epithelioma, and (c) flat or alveolar carcinoma. The commendable simplicity of this classification becomes apparent in a review of the recorded neoplasms which are designated by a score of terms descriptive of their microscopic architecture.

The papillary tumors of the renal pelvis as encountered by the surgeon may be apparently benign, or possibly or obviously malignant. Infiltrating non-papillary, or alveolar, carcinomata are always malignant. A neoplasm which fulfills both the gross and microscopic qualifications of benignancy may

* Read before the Philadelphia Academy of Surgery, February 4, 1929.

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prove to be most malignant, as evidenced by prompt local recurrence and metastatic dissemination. It is probably of little practical importance whether a papillary carcinoma has resulted from the malignant transformation of a primary benign growth, or has been malignant from its beginning. Peculiarities in the pathogenesis of intrapelvic tumors and their clinical features have been discussed at length by Albert Scholl,⁷ Thomas and Regnier,¹¹ Gilbert and Smith,¹ and other recent writers. The consensus of opinion is that all papillary tumors are inherently malignant and that the microscopic characteristics of benignancy do not insure innocent behavior on the part of the tumor.

It is our purpose to present a series of seven cases of intrapelvic tumors, and to review the subject chiefly from the standpoint of diagnosis.

CASE I.—Benign Papilloma of the Left Renal Pelvis. M. B., fifty-four years of age, was admitted to the Pennsylvania Hospital September 14, 1928; discharged September 21, 1928. Readmitted October 15, 1928; discharged November 3, 1928. Chief complaint: blood in urine.

History.—Perfectly well until two weeks ago when he noticed bright red blood in his urine; this continued without interruption for about one week, then stopped off two days, after which he noticed blood again, and it has continued until the present (September 14). He thinks that the amount of blood has increased since the onset. There have been no clots—no other urinary symptoms—no dysuria or renal colic. He is a well-nourished adult male; no dyspnoea or cyanosis. Physical examination negative.

Cystoscopy.—No. 18 cystoscope introduced easily; bladder urine bloody, some blood clots in bladder, bladder is tolerant, moderate trabeculation; no cystitis. *Bloody urine seen coming from left ureter.* Prostate—moderate lateral and median lobe hypertrophy. *No neoplasms found.* Left ureter catheterized. Bloody urine from left kidney. This specimen was filled with blood, no pus, acid in reaction, free from casts, culture sterile, no acid fast organisms. Capacity of left kidney pelvis ten cubic centimetres.

Divided function (phthalein)—*appearance time:* Right, not taken; left, five minutes. *Percentage output:* First fifteen-minute collection—right, 10 per cent.; left, 5 per cent. Second fifteen-minute collection—right, 7.5 per cent.; left, 2.5 per cent. Total, 17.5 and 7.5 per cent., respectively.

Plair Röntgenogram.—Negative.

Pyelography (Fig. 1).—Stereoscopic pyelograms were made on September 18, 1928, and October 3, 1928; 12 cubic centimetres of 15 per cent. sodium iodide used. Pyelogram, Fig. 1 (Pennsylvania Hospital X-ray Laboratory, No. 67863), was reported as follows: "There is a defect in the region of the upper calix of the left kidney. I believe that it represents a lesion, possibly a tumor. Ureterogram normal." (Doctor Bowen.)

Laboratory Data.—Numerous studies failed to disclose tubercle bacilluria. The urine became chemically and microscopically normal soon after the hæmaturia ceased. September 14, 1928: hæmoglobin 83 per cent., red blood cells 4,230,000, white blood cells 7200, blood urea 14 milligrams.

Pre-operative Diagnosis.—Intrapelvic neoplasm—probably papillary in type, involving the upper calix and adjacent portion of the true pelvis.

The patient left the hospital but returned October 15 and the kidney was removed next day. At operation the kidney was grossly normal, but section after its removal disclosed the neoplasm described below. The ureter was normal. Convalescence was uneventful; the patient is without symptoms (February 1, 1929).

Post-operative Diagnosis.—Benign papilloma of the pelvis of the kidney involving the upper portion of the true pelvis and upper calix.



FIG. 1.--(Case I.) See also Figs. 2 and 3. Pyelograms in case of benign papilloma of the renal pelvis. Note the absence of the superior calix, the filling defect of the adjacent portion of the true pelvis and dilatation of one calix, due to partial occlusion of its ostium. To the inner side, the median extends upward, partly surrounding the neoplasm.

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Laboratory Report.—Surgical No. 13757. Specimen, kidney (Figs. 2 and 3). Date, October 16, 1928. The specimen of a longitudinally sectioned kidney measuring 11.5 x 5.5 x 5 centimetres. The capsule strips easily and discloses a finely granular, even surface throughout. The color of the kidney is normal; medullary tissue preponderates over the thinned cortical tissue, but the contrast is well maintained. There is a pale pink, cauliflower-like growth occupying the upper two-fifths of the pelvis. It is firmly bound to the pelvic membrane. It appears to be part of the membrane and, also, to be invading the upper calix to a moderate degree. Further sections reveal very little invasion of the kidney parenchyma.

Summary and Comments.—A male, fifty-four years of age, had the initial and only urinary symptom, a frank hæmaturia, on September 5, 1928. October 5, 1928, the kidney was removed. Cystoscopic examination disclosed the source of the bleeding as the left kidney. While bleeding, this kidney failed to excrete phthalein in forty-five minutes, but when the bleeding had ceased the function was about half normal. There was no retention in the pelvis, proving the absence of an obstructive lesion. There was no demonstrable infection. The plain röntgenogram was negative. There were no neoplasms to be found in the bladder. The ureter was patulous.

The first pyelogram revealed a small filling defect in the upper portion of the true pelvis with effacement of the upper major calix. The defect did not explain satisfactorily the very much diminished renal function. A second functional study made after the hæmaturia had ceased disclosed only moderate dysfunction. (NOTE: A bleeding kidney, whatever the cause of the bleeding and however normal the organ, may show poor ability to eliminate dyes.) A second pyelogram disclosed not only the defect already noted, but also small crescentic streaks which extended upward from the filling defect indicating that the medium had surrounded an intrapelvic mass. This, together with the fact that the renal function was only moderately diminished, led to the diagnosis of intrapelvic tumor, while the configuration of the filling defect justified the belief that the tumor was papillary in type rather than flat. The normality of the bladder, as revealed cystoscopically, and the normal ureterogram indicated the absence of secondary implants. The tentative diagnosis of intrapelvic papillary new growth was confirmed at operation.

CASE II.—Extensive Non-Papillary Carcinoma of the Right Renal Pelvis in a Negro. E. J., negro, fifty-one years of age, was admitted to the Pennsylvania Hospital November 19, 1923; died December 18, 1923. Chief complaint: Pain in the right groin and leg.

Present Illness.—Perfectly well until June, 1923, when he first noted pain which rapidly increased in severity. The pain which was "dull and dragging", and worse at night, could be reduced somewhat by lying on his left side. He was confined to a hospital during July and August, and was somewhat improved by the rest. No urological



FIG. 2.—(Case I.) Benign papilloma of the renal pelvis. The size and position of the neoplasm explains the pyelographic defect (Fig. 1).

examination made according to the patient. No treatment, and only moderate suffering until November, 1923, when he began to have severe pain in the right loin referred to the testicle and right leg. Pain increased by extending the leg. There is marked urinary frequency and dysuria. Has lost sixty-two pounds in weight. Patient states that he has had numerous chills. Had gonorrhoea and possibly chancre twenty-six years ago. (Wassermann now negative.)

Physical Examination.—Tall, emaciated, middle-aged negro who complains bitterly

of pain in the right lower abdomen radiating downward. This pain is increased by deep breathing and movement of the leg. The entire right side of the abdomen is tender and very rigid. The extreme muscular rigidity precludes accurate abdominal palpation, but no definite mass can be outlined. There is no palpable enlargement of the left kidney. No tenderness in the left loin. The urine is pus-laden and contains some red cells. The specific gravity is low. November 21, 1923: Hæmoglobin 70 per cent., red blood cells 3,400,000, white blood cells 20,600, urea nitrogen 24.2, creatinine 2.1.

Cystoscopy revealed extensive cystitis with marked œdema of the trigonal area. Ureteral orifices not found. Daily irrigations of the bladder ordered.

Cystoscopy, November 27, 1923. Cystitis improved. Left ureteral opening in normal position. Pus-laden urine obtained by catheter from left kidney. Right ureteral orifice in mid-line of bladder—apparently a congenital anomaly. Right ureter blocked eight centimetres from orifice. No urine obtained.

Indigocarmine (intravenous) appeared from the left kidney in fair concentration in six minutes. None from the right kidney after fifteen

minutes. *Cystoscopy*, December 3, 1923. Cystitis greatly improved. Hazy urine from left kidney. Right ureter blocked in mid-abdominal portion. No urine obtained. Indigocarmine eliminated by the left kidney in eight minutes in good concentration. None from the right in twenty-five minutes.

On December 10, 1923, bulging, marked rigidity and tenderness of right side of abdomen noted. However, the patient's general condition and renal function were improving. The urinary infection had improved markedly. The phthalein output (two hours' collection) had gradually increased to 65 per cent.

Plain skiagrams were of no assistance in diagnosis.

Cystoscopy, December 11, 1923. The improvement of the cystitis and left renal infection continues. Indigocarmine is now eliminated from the left kidney in five minutes in full concentration. The right kidney is functionless. The right kidney is unquestionably dead, and the left kidney, which was badly infected and low in function, has improved in function and is now mildly infected.

Pre-operative Diagnosis.—Functionless right kidney; possibly an infected malignant kidney. (In a very similar case the condition proved to be an infected sarcomatous kidney; in this case pyelographic distortion led to the diagnosis of infected renal neoplasm.) Obviously the case under discussion was not an ordinary pyonephrosis but, owing to ureteral occlusion, pyelographic study was impossible. However, it seemed advisable to explore the kidney transperitoneally. This was done by one of our confreres.

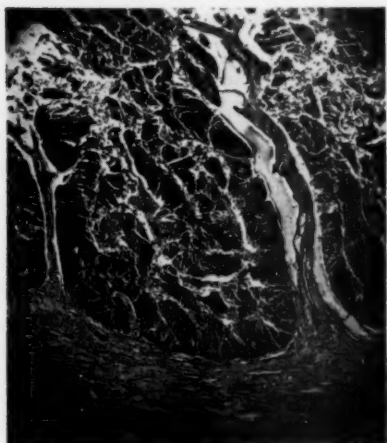


FIG. 3.—(Case I.) The tumor is a delicate papillary structure, growing in large irregular groups separated by delicate fibrous tissue septa which are infiltrated with a few round cells. The cells comprising the tumor are columnar for the most part and show large, rather evenly staining nuclei, none of which show division. The basement membrane is not broken and no invasion of the underlying renal tissue, which, in general, is in a fair state of preservation, except for moderate degenerative changes of the tubular epithelium. The degree of malignancy is low, this structure suggesting a papilloma of the renal pelvis. (Bauer.)

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The left kidney was apparently normal, the right one extensively diseased. The mass which was very hard and nodular and densely adherent extended well beyond the mid-abdominal line and below the umbilicus. The mesenteric glands were enlarged and indurated. Mobilization of the mass was attempted, but the patient died before this could be accomplished.

Pathological Report (Figs. 4 and 5).—Surgical No. 9877. Specimen, growth and kidney. Date, December 18, 1923. This specimen consists of a large kidney weighing

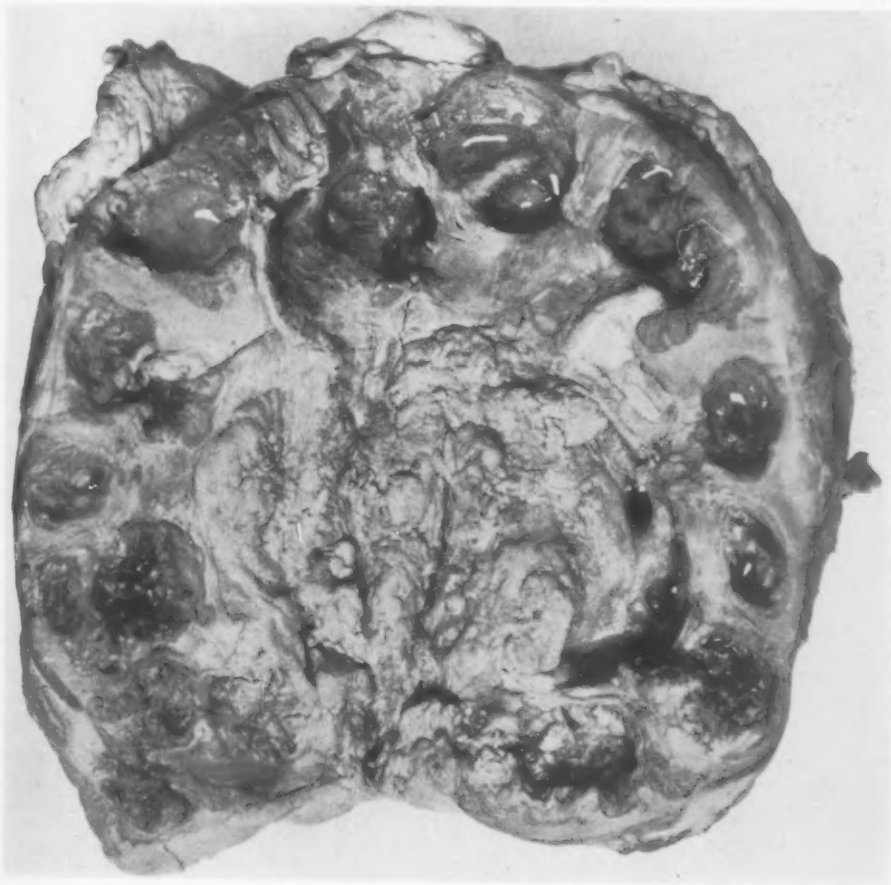


FIG. 4.—Non-papillary carcinoma of the right renal pelvis.

530 grams. It is covered with patchy hæmorrhagic areas, but, for the most part, the parenchymatous portion is quite pale in color. Scattered over the surface are many elevated irregularities, some of which appear as cauliflower-like projections and others as rounded elevations from an inner saccular dilatation.

On opening, the picture in general is that of a hydropyonephrosis. The pelvis is found to be dilated and filled with purulent fluid. There is an extreme degree of destruction of renal tissue with many saccular dilatations of the calices which extend through medullary and cortical portions of the parenchyma. In the pelvis there is a large cauliflower-like mass of pale semi-friable tissue protruding into the pelvis lumen, partially obstructing the ureteral orifice. It cannot be said, from gross examination, to exhibit the appearance of a papillary type of growth. This type of tissue which is most

prominent in the pelvis seems to spread out in a thick layer (5 millimetres) which lines the dilated calices throughout the renal parenchyma and is seen as a yellowish lining in contrast to the fibrosed renal tissue beneath. Evidences of an acute suppurative process mask the picture somewhat.

Microscopical Examination (Fig. 5).—The microscopic picture is masked by the presence of an acute suppurative infection with a great deal of associated necrosis. Sections of the pelvic mass show that it is composed of infected tumor tissue. The

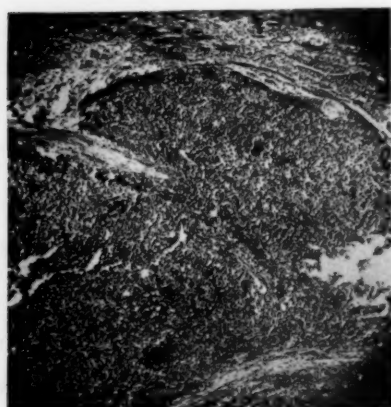


FIG. 5.—(Case II.) See also Fig. 4. This represents the most malignant of the series. While the section reveals a greater atypical papillary arrangement with little stroma, the cells themselves are more irregular in shape and size, at places produced tumor giant cells with hyperchromatic nuclei. The degree of invasion, however, cannot be satisfactorily determined, for a massive acute infection, evidenced by polymorphonuclear cells, masks the picture by infiltrating the entire remaining renal tissue. The compression of renal tissue and the lack of a basement membrane are readily indicated. (Bauer.)

majority of the tumor cells are large, slightly elongated and occasionally fusiform, seen lying in small groups surrounded by a very fine network of thread-like fibrous stroma. A heavy fibrous stroma, however, is seen ramifying here and there through the mass, but the relation of the tumor cells to this stroma is not clearly defined. It does not appear to be that seen in a papillary type of growth. Evidences of acute and chronic infection are prominent with a great deal of necrosis, enormous numbers of polymorphonuclear leucocytes and occasional giant cells. The same type of tumor tissue, noted in the pelvic mass, is seen lining the dilated calices in which strands of tumor cells line and penetrate into the underlying fibrous tissue. This is evidently an epithelial tumor arising from renal pelvis of distinct malignancy. The type is not clearly defined.

Diagnosis.—Carcinoma of renal pelvis. Pyonephrosis.

NOTE.—Sections seen by Dr. J. McFarland, University of Pennsylvania, agree with above diagnosis. No further classification made. We report the case as one of non-papillary carcinoma on account of the extensive flat growth involving

the pelvic walls (Fig. 4), and the absence of a typical papillary structure in the microscopic sections.

CASE III.—Papillary Carcinoma of the Left Renal Pelvis. Carcinoma of the Right Kidney. Source Undetermined. Possibly a Primary Papillary Neoplasm of the Pelvis. Multiple Implants in the Bladder. C. E. J., fifty-nine years of age, white, was admitted to the Pennsylvania Hospital June 5, 1924, referred by Dr. John H. Gibbon for diagnostic study. Chief complaint: Hæmaturia.

Present Illness.—Onset October 23, 1923, with hæmaturia which lasted a few days, reappearing three weeks later. Hæmaturia has continued intermittently until the present. No other symptoms.

Three weeks ago was seized with pain in the left mid-abdomen which shifted to the left flank and continued for three hours. No change in the urinary symptoms.

Past Medical History.—Gonorrhœa at nineteen. Fracture of the pelvis three years ago.

Physical Examination.—Negative except for an indefinite mass in the upper right abdomen. This mass was not identified but was, in all probability, the kidney. The left kidney which contained the papillary tumor could not be felt.

Cystoscopy revealed a trabeculated bladder. No diverticulæ seen. Three small papillomata on posterior wall of the bladder, size of small peas. Moderate intravesical enlargement of the prostate gland. Large amounts of blood ejected in spurts from the left ureteral orifice. No blood from the right. No. 6 catheters to the kidney pelves.

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FIG. 6.—(Case III.) Pyelogram in case of papillary carcinoma of the renal pelvis. Note the extensive filling defect of the true pelvis, obliteration of the inferior calices and dilatation of the superior calices. This is a most characteristic picture of papillary tumor of the renal pelvis. Compare the pyelogram with Fig. 7, which shows the papillary growth and the dilated superior calices.

Bloody urine from the left kidney. Hazy urine from the right kidney. Cultures of these specimens were sterile.

Divided function (phthalein)—*appearance time*: Right, three minutes, good concentration; left, seven minutes, moderate concentration. Owing to patient's intolerance to instrumentation collections for percentage estimation of the dye were not made.

Pyelography (Fig. 6).—No. 6 catheter to pelvis of left kidney; considerable thick white fluid obtained. No blood. Pelvic capacity slightly increased. Twelve cubic

centimetres of 25 per cent. sodium iodide injected. The pyelogram, Fig. 6, shows a characteristic filling defect due to intrapelvic neoplasm with secondary dilatation of some of the calices. We did not make this diagnosis positively notwithstanding the presence of implants in the bladder. We did advise renal operation, however, with the statement, "I am inclined to believe that this is a case of bleeding nephritis, although the possibility of bleeding neoplasm cannot be excluded. I would advise exploration of the left kidney. The right kidney seems to be slightly decreased in function".

Owing to the poor general condition of the patient and evidences of nephritis, it was decided to postpone operation for a brief time. After the hæmaturia ceased the urine became essentially normal except for a fixed low specific gravity and faint traces of albumin. There was a moderate degree of secondary anaemia: hæmoglobin 65 per cent., red blood cells 2,820,000, white blood cells 13,200. The blood chemistry was as follows: Sugar 103 milligrams, urea nitrogen 16.8 milligrams, creatinine 1.6 milligrams.

Second Admission.—July 1, 1924, two days before re-admission the patient had a violent attack of pain in the left flank following which he passed large amounts of clotted blood.

Operation July 7, 1924, by Doctor Gibbon. Curved left lumbar incision. Enlarged congested



FIG. 7.—(Case III.) Kidney containing a papillary tumor occupying the true pelvis and inferior calices. Note the dilated ostium of a superior calix above the mid-line of the kidney and a dilated calix at the upper pole. Compare these findings with pyelographic defect (Fig. 6).

kidney exposed and removed. There was no evidence of metastases or involvement of the perirenal fat which was, however, somewhat thickened and indurated. On incision of the kidney a papillary mass was found in the pelvis. The convalescence was uneventful except that slight hæmaturia persisted and the urine contained considerable pus. Prior to operation the specific gravity was persistently low and the highest phthalein elimination was 32 per cent.

Pathological Report (Figs. 7 and 8).—The kidney (Fig. 7) measures twelve centimetres in length, and presents a slightly congested surface and enlarged pelvis. Bulging from the pelvic wall is a cauliflower-like growth, 3 x 2 centimetres, which is rounded and has a granular, crumbly centre. On laying open the kidney, an area of necrosis with carcinomatous infiltration is exposed beneath the pelvis. The rest of the kidney is pale and looks degenerated, but no growths outside of the mass mentioned can be made out. Firm white hyalin-like tissue surrounds the growth.

Additional Data.—We hoped to destroy the bladder papillomata by electrical desiccation but found that in the interval a dozen or more growths had appeared, some of them situated in the region of either ureteral orifice. These implants grew with astonish-

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ing rapidly, far more rapidly than any benign papillomata of the bladder, although they presented no tendency to infiltrate the bladder wall. The mass in the right flank, noted above, became more easily palpable. On October 29, 1924, Doctor Gibbon explored the abdomen and found an extensive carcinoma of the right kidney pelvis with nodular involvement of the parenchyma and metastases to the liver. The patient died in coma on December 12, 1924.

Summary and Comments.—The patient, a man, fifty-nine years of age, had intermittent hæmaturia from October, 1923, until his admission to the Pennsylvania Hospital in June, 1924. During this time three physicians failed to make a diagnosis. A cystoscopist failed to find either the source or the cause of the bleeding. In June, 1924, several small papillomata were found in the bladder; the left kidney contained a bleeding lesion and was diminished in function. The right kidney was likewise slightly diminished in function, but was not bleeding. There was a palpable mass in the upper right abdomen, the identity of which was not made with certainty. Our pyelographic studies indicated the presence of a serous left renal lesion and the defects disclosed (Fig. 6) were typical of intrapelvic tumor, although this diagnosis was made only tentatively in the case. As the result of the study, however, nephrectomy was decided upon. The kidney contained a large papillary carcinoma of the pelvis.

The implants in the bladder grew with great rapidity, not in size alone, but also in number. The futility of fulguration became evident. A palpable mass, possibly of right renal origin, grew in size. Exploration proved this to be a carcinomatous kidney. There were metastatic nodules in the liver. This case indicates the advisability of bilateral pyelography. It is possible that the neoplasm of the right kidney in our case was metastatic from the neoplasm of the left kidney. Metastatic carcinoma of the kidney is not uncommon.

CASE IV.—Papillary Carcinoma of the Right Renal Pelvis with Secondary Hydro-nephrosis and Ureteral Implant. E. A. R., female, white, sixty-eight years of age, was admitted to the Pennsylvania Hospital May 19, 1922. Chief complaint: Hæmaturia. Intense steady pain in the right lumbar region and right hip.

Present Illness.—Began three months before with severe aching pain in the right loin and right hip. This has been constant although somewhat relieved by lying down. Several attacks of hæmaturia during which there have been dysuria and frequency. Has lost much weight. Appetite poor. Quite weak. Sleeps poorly and is extremely nervous.

Past Medical History.—One severe preliminary hæmorrhage fifteen years ago. Six attacks of rheumatic fever.

Physical Examination.—Poorly nourished, anæmic elderly female. Complains of constant severe pain in right loin and hip. Patient is somewhat deranged mentally. There is considerable myocardial weakness and a systolic apical murmur. Some dullness over both apices. Abdominal examination discloses muscular rigidity on the right side and tenderness over the right loin and right iliac area. No masses palpable. Subsequently we could palpate a large kidney mass on the right side. (Intermittent hæmatonephrosis?) The urine was laden with blood cells. Wassermann negative. Two hours' phthalein output—20 per cent. Hæmoglobin 70 per cent., red blood cells 4,230,000, white blood cells, 10,800.

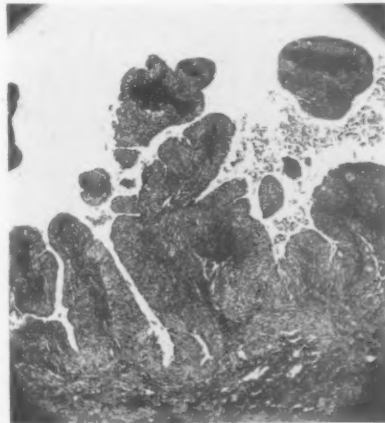


FIG. 8.—(Case III.) The structure of this is very much like that of Fig. 3 (Case I), and reveals a thick epithelial papillomatous structure in which the cells deviate very little from that of the normal epithelium, although definitely increased in amount. The basement membrane appears to be broken at places. Cellular infiltration beneath the tumor indicates a reaction against its proliferation and invasion. Again few changes are seen in the renal parenchyma, although moderate scarring, hæmorrhage and cellular infiltration of an inflammatory type exist.

Cystoscopy.—Bladder urine clear. Bladder tolerant and capacious. Sphincteric margin studded with small cysts. Left ureteral orifice normal. Projecting from the right ureteral orifice is a plug of mucus. The orifice is surrounded by oedematous mucosa and just posterior to it there is a solid neoplasm (Fig. 9) which seems to have broken through the roof of the ureter to enter the bladder. The ureter is obstructed at this point. Left ureter admits catheter. Urine clear. No pelvic retention.

Divided function (phthalein)—*appearance time*: right, none in forty minutes; left, three minutes. The right kidney is functionless, the left one somewhat impaired in function as indicated by a total output in two hours of only 20 per cent.



FIG. 9.—(Case IV.) See also Fig. 10. Carcinoma of the lower ureter secondary to carcinoma of the renal pelvis. The neoplasm has ulcerated through the ureter to invade the bladder.

Röntgenograms.—No evidence of calculi. There is an advanced osteo-arthritis involving all the limbs and part of the dorsal spine. The chest is negative. No evidence of metastatic neoplasm.

Operation.—June 13, 1922. Lumbar nephrectomy. There were dense adhesions in the region of the uretero-pelvic junction. The ureter was much thickened and adherent. There was no palpable evidence of ureteral involvement except in the upper portion. The kidney was large and apparently hydronephrotic. Convalescence uneventful except for mental condition. June 30, 1922, fifty milligram hours of radium were applied to ureteral tumor.

Post-operative Course.—The patient developed increased psychic symptoms of

the paranoid type, and was transferred to the Philadelphia Hospital where she remained five months. Since her discharge we have been unable to trace her.

Pathological Report.—The specimen is a kidney (Fig. 10) measuring 11.5 × 5 × 3 centimetres. The centre is thinned to three millimetres. The pelvis is dilated together with the calices. The upper ureter and adjacent segment of the true pelvis are represented by a hard thick mass of tissue. NOTE.—Grossly this neoplasm seemed to be a flat non-papillary neoplasm possibly of the squamous-cell type. Recent studies of the specimen by Dr. Charles Bauer have disclosed certain areas in which the tumor-cell arrangement suggests pearly body formation, but the essential architecture is papillary and the neoplasm is so classified. Doctor Bauer's description of the microscopic features accompanies. (Fig. 11.)

Summary and Comments.—Both the renal enlargement and pain in the case were probably caused by the hydronephrosis rather than by the neoplasm itself. The presence of a ureteral tumor causing occlusion prevented pyelographic study of the kidney on the involved side; this would have failed, however, to disclose the condition no doubt on account of upper ureteral closure grossly; the neoplasm seemed to us to be non-papillary in type, but apparently the superficial fimbriae had been destroyed, leaving a flat surface. The presence of an implant in the ureter was suggestive of a primary papillary tumor of the kidney pelvis since non-papillary neoplasms do not give rise to implants. From the microscopic standpoint this tumor was more malignant than that in Case I and less malignant than that in Case III.

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CASE V.—*Papilloma of the Left Renal Pelvis with Ulceration of the Pelvic Walls and Extravasation of Urine.* J. S., male, white, fifty-two years of age, presented himself for office examination with the statement that he had fallen from a chair, landing on his buttocks, and that twenty hours thereafter he developed a symptomless hæmaturia lasting two days. The left kidney was found to be the source of cloudy urine containing blood.



FIG. 10.—(Case IV.) Apparently, a flat carcinoma at the uretero-pelvic junction with hydronephrosis. This was associated with ureteral implant (Fig. 9). Doctor Bauer finds that the tumor is papillary in type (Fig. 11). The kidney was closed.

The bladder was normal. The patient entered the hospital May 6, 1926; the following data are taken from the hospital records:

Chief complaint: Hæmaturia.

Present Illness.—Six weeks ago had a fall (as above stated) followed by hæmaturia. The latter disappeared after two days, but recurred four days before admission to the hospital. No other symptoms.

Past History.—Seven years ago had a severe attack of colicky pain in the left lumbar region. This was relieved by an injection of morphine. There was no gross hæmaturia. There has been no recurrence of the pain which during the initial and only attack persisted with more or less intensity for two months.

Cystoscopic Examination.—Bladder normal. No. 6 catheters to the renal pelves. No ureteral obstruction demonstrable. No pelvic retention. Clear urine from the right kidney. Bloody urine from the left kidney.

Divided function (phthalein)—*appearance time*: Right, four minutes; left, none in twenty minutes. *Percentage Output*: Fifteen-minute collection—Right, 20 per cent.; left, none.

Pyelogram.—Notwithstanding the absence of demonstrable retention sixty cubic centimetres of sodium iodide was injected into the left kidney without causing pain. Unfortunately, this pyelogram cannot be found, but it was reported as showing "a filling defect probably caused by a tumor". The total phthalein output was 20 per cent., urea nitrogen 21.6 milligrams, creatinine 1.6. The Wassermann was negative.

The patient left the hospital but returned May 25 for operation. Medical consultant advises that digitalis be given prior to operation on account of myocardial weakness. At this time no abdominal masses were palpable.

A second pyelogram (Fig. 13) was made, using 80 cubic centimetres of sodium iodide. This is reported as showing "renal enlargement at the expense of the kidney substance as well as the pelvis of the kidney". It will be noted that there is a marked filling defect associated with dilatation of certain calices and a large fan-shaped shadow extending outward from the region of the filling defect. This we were unable to explain, but we felt quite certain that the condition was one of papillary neoplasm of the renal pelvis. The patient's condition improved somewhat. On May 25, the phthalein output was 43 per cent. On June 6 a very serious hæmorrhage occurred—so serious that immediate nephrectomy became necessary. The kidney and perirenal fat were removed *en masse* without serious difficulty, but the patient died of cardiorenal failure and hypostatic pneumonia on June 12, following.

Pathological Report (Figs. 12 and 14).—Specimen is a thick-walled sac within which are the remnants of a kidney. The sac comprises greatly thickened perirenal fascia and fat. It is irregular in shape but measures 15 x 8 x 7 centimetres. The remnants of the kidney measure 10 x 5 x 4 centimetres. The kidney is attached firmly to the sac wall except posteriorly where a cavity separates the two structures. This cavity represents the perirenal space; a portion of which has been walled off by reactive inflammation in the perirenal fat. No tumor is visible from the outside, but the pelvic cavity and perirenal space communicate. There is a small amount of bloody fluid in the perirenal space. On section the kidney tissue is found to be much thinned out in places, thickened in others; some calices are dilated, others obliterated. There is a mass of fairly firm pale-colored tissue almost filling the pelvic cavity and attached to it broadly. On section this mass appears to be softened and partly necrotic. The renal parenchyma presents marked fibrosis, but there is no infiltration of tumor cells.

Sections of the central mass show typical papilloma in which fairly thick coils of

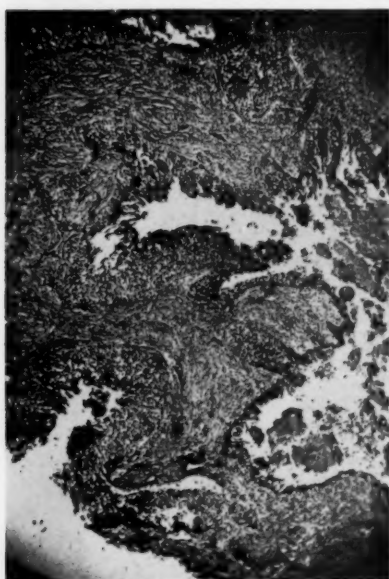


FIG. 11.—(Case IV.) The tumor of this kidney is a definitely papillomatous structure, much more advanced in degree of proliferation than the former one, and the epithelial cells comprising it show all changes from regular columnar-shaped, transitional epithelium to enlarged cells with atypical pale vesicular nuclei in which the chromatin is distinctly increased in staining reaction and amount. Some of these cells are arranged in an oval manner suggesting the formation of epithelial pearls. The renal tissue has been greatly compressed, destroyed, invaded by the papillomatous structure and greatly infiltrated with cells. Unquestionably there is a hydronephrosis produced by the papillomatous structure which is definitely malignant and represents in this series a more malignant condition than Fig. 3 (Case I).

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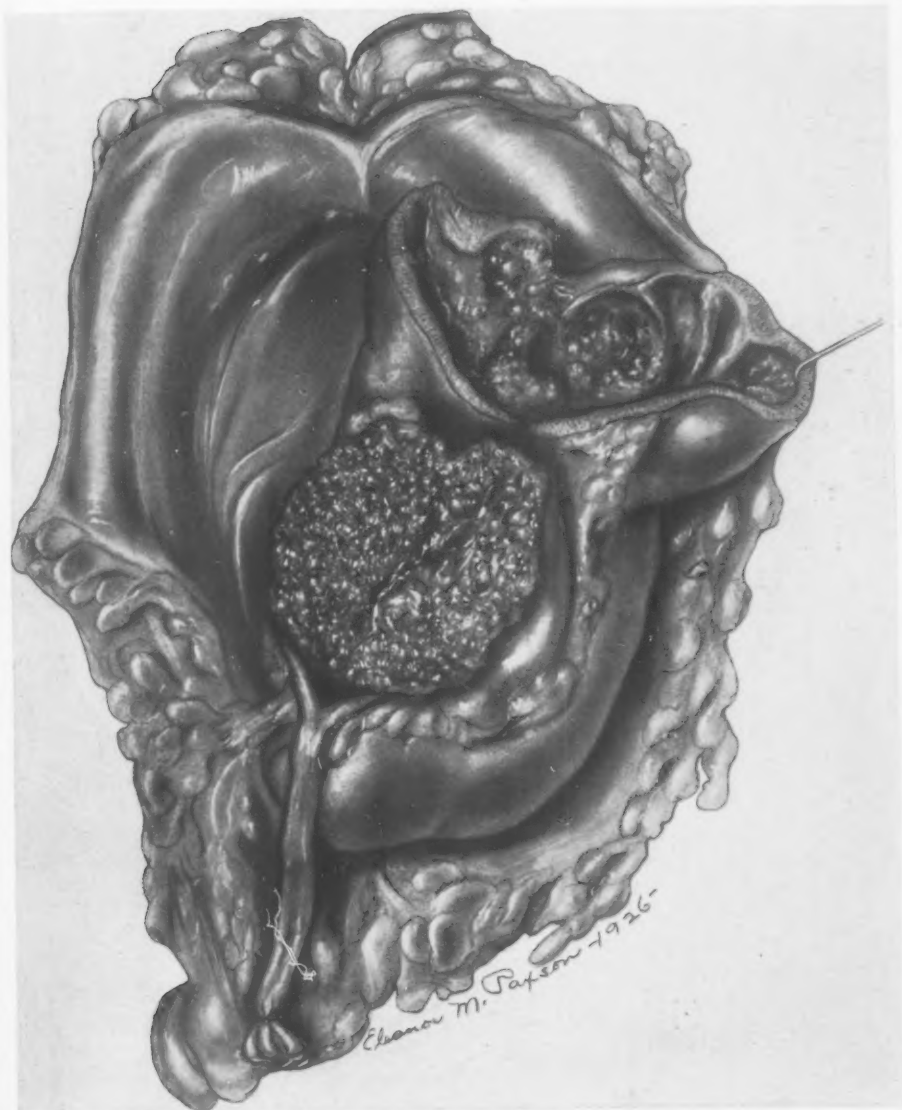


FIG. 12.—(Case V.) Kidney containing a large papillary tumor of the true pelvis with extensions into some of the calices. The superior calices are dilated (see Fig. 13). Note the marked thickening of the perirenal fat and the space between the latter and the kidney into which the pyelographic medium gained entrance through a rent in the true pelvis.



FIG. 13.—(Case V.) Pyelogram showing the most typical feature of deformity due to papillary intrapelvic neoplasm, namely, filling defect of the true pelvis, obliteration of the lower calices and dilatation of the superior calices. Note the large shadow below and to the outer side of the filling defect. This, which we were unable to explain, represents medium which has found its way through a rent in the pelvis into the perirenal space behind the kidney. (See Fig. 12.)

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connective tissue are surrounded by several layers of epithelial cells. No masses of epithelium or other malignant features noted. (Fig. 14.)

Diagnosis.—*Papilloma of the renal pelvis* with pelvic ulceration permitting extravasation of urine.

NOTE.—I think that serial sections of this tumor would have disclosed papillary carcinoma (Herman).

SUMMARY AND COMMENTS.—This patient apparently had a papilloma of the left kidney for a long time—possibly seven or more years. Trauma may have been influential in causing necrosis leading to hæmaturia. There is a possibility that the distention of the kidney during pyelography promoted ulceration of the pelvic walls leading to urinary extravasation. It is also possible that the serious hæmorrhage which occurred nine days after the last pyelography was caused by renal distention. The pyelograms were made without pain, however, and there were no clinical signs of renal rupture which apparently occurred very slowly as the result of neoplastic and inflammatory erosion. The pyelogram shows not only the filling defect and dilatation of some of the calices suggestive of intrapelvic tumor, but also a collection of medium behind the kidney.

This patient's death was due largely to the serious renal hæmorrhage which occurred shortly before operation.

CASE VI.—Extensive Renal Carcinoma Probably of Pelvic Origin. The following case was studied by Doctors Lippincott and Bentley, of Camden, N. J., to whom we are indebted for the clinical notes and pyelogram (Fig. 15). C. A., male, white, sixty years of age, was admitted to the Cooper Hospital, July 5, 1928. The chief complaints were pain in the left side and weakness.

The present illness had lasted one year. Initial symptoms brick dust appearance of the urine. Slight frequency. Gross, painless, intermittent hæmaturia soon developed. Four months before admission he began to have fixed pain in the upper left abdomen. The pain and hæmaturia became progressively worse. Weakness has been noted for several weeks.

Physical Examination.—Well-nourished adult male. No abnormal findings except tenderness and rigidity over the upper left abdominal quadrant. No definite mass found. No evidence of metastases. The urine contained blood. Blood chemical studies were essentially normal. There was mild anaemia. The Wassermann test was negative. Prostate not enlarged to rectal examination.

Cystoscopy (Doctors Lippincott and Bentley).—Bladder urine clear. Bladder normal. Considerable intravesical enlargement of the prostate gland. Clear urine obtained from the right kidney. The catheter on the left side became occluded by blood clots and had to be replaced; after this, the urine collected from the left kidney was clear.

Indigocarmine appeared in five minutes from the left, and in four minutes from the right kidney. The renal function seems to be normal.

Pyelography (Fig. 15).—Twenty cubic centimetres of sodium iodine solution injected into the left renal pelvis—no pain. At another time a double pyelogram was made to compare the shape of the two pelves.

Subsequent Course.—The patient had no further treatment until December, 1928, when he was admitted to the Burlington County Hospital, New Jersey, under the care of Doctor Reimer, with whom we saw the case in consultation. At this time, the man



FIG. 14.—(Case V.) Papilloma of the renal pelvis; no evidence of malignancy. (See Figs. 12 and 13.)

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was emaciated and anæmic. The pain and hamaturia had persisted more or less constantly. The mental condition had cleared up, but there was a constant severe boring pain in the lower left chest and upper abdomen. It had been necessary to use opiates

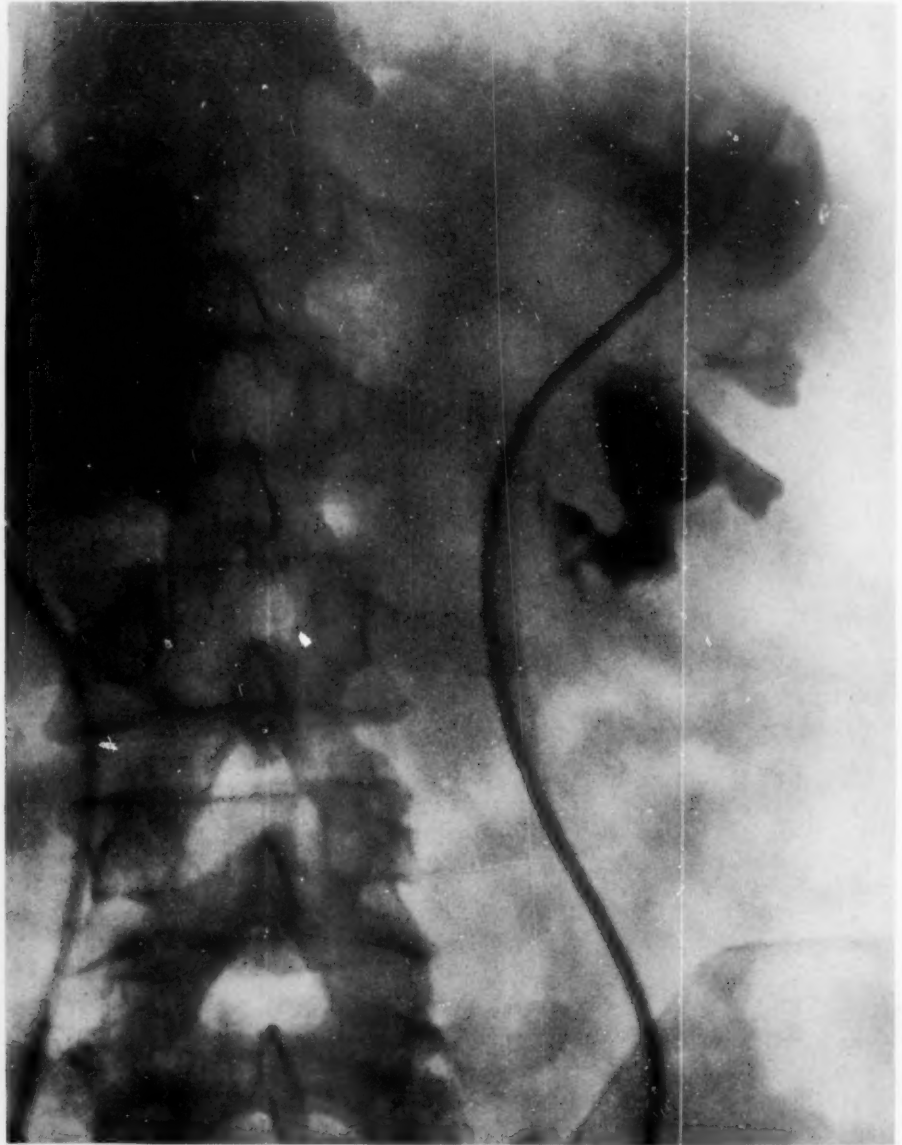


FIG. 13.—(Case V.) Note the filling defect of the true pelvis, distention of the upper portion with filling defects, and small filling defects of the lowermost calix.

for some time to control this pain. We could not outline a mass in the renal area nor could evidence of metastases be found.

On the basis of the pyelographic findings of Doctors Lippincott and Bentley and the course of the disease we were of the opinion that the condition was one of inoperable renal carcinoma. The kidney was explored through a loin incision. The organ

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was found to be enlarged moderately, nodular throughout, a stony hard and densely adherent. Attempts to remove it seemed to us to be contraindicated.

SUMMARY AND COMMENTS.—The pyelogram (Fig. 15) which shows a marked filling defect of the true pelvis, invasion of the upper pole of the kidney and dilatation of the lower calices, indicated the presence of an extensive intrapelvic neoplasm, probably papillary in type and, in all probability, carcinomatous.

Normality of function of this kidney in July, 1928, would indicate that the parenchyma was little involved at this time, although the pyelogram suggests considerable parenchymal invasion. At operation five months later the entire kidney was involved; it had become inseparably bound to the perirenal structures and, in all probability, metastasis had already occurred.

CASE VII.—*Papillary Carcinoma of the Left Kidney.* J. P., white, sixty years of age, was admitted to the Methodist Hospital, of Philadelphia, on account of hæmaturia, beginning one month ago when the patient passed a red, pencil-like mass in the urine. This he describes as snake-like and about six inches in length. Six years ago there was an attack of lumbar pain (side not stated) lasting one week. There had been no symptoms following this until one month ago. On admission to the hospital the man was having great bladder distress. There was some residual urine. The urine was filled with blood. The prostate gland was moderately enlarged, but not indurated. A medical consultant reported moderate chronic myocarditis and the presence of râles in both lungs (basal).

There was moderate secondary anaemia: hæmoglobin 73 per cent., and the functional studies showed marked renal dysfunction. The highest phthalein elimination was 10 per cent. for a two-hour period. The blood urea nitrogen was 38.5 milligrams.

Cystoscopic Studies.—The initial cystoscopy disclosed a rigid deep urethra. The bladder was filled with bloody urine and clots. There was very marked trabeculation. The viscus was large in capacity, but during cystoscopy was intolerant so that an imperfect view was obtained. The entire trigone and sphincteric margin were studded with small cystic bodies and there was considerable œdema. There were several ecchymotic areas surrounding the right ureteral orifice. We could not rule out with certainty a basal carcinoma.

A second cystoscopic examination was made August 10, 1927, for the purpose of reexamining the bladder and study of the upper urinary tract. The source of the bleeding had not been determined. The patient had great bladder distress and was rapidly losing ground. Again it was found impossible to catheterize the ureters on account of extensive œdema. We were of the opinion, however, that the hæmaturia was of upper urinary origin on account of the history of the passage of ureteral (worm-like) clots, absence of a demonstrable bleeding lesion of the bladder, and the low renal function. Due to the latter, the indigocarmine test was of no service in locating the ureteral orifices.

Treatment.—The intensity of the patient's bladder distress and the probability of improving renal function thereby prompted us to drain the bladder. This was done by Doctor Greene August 15, 1927.

A third attempt to determine the source of the hæmaturia was made after the cystotomy and we succeeded in introducing a catheter into the left ureter for a distance of six centimetres and recovered clear urine. There were no palpable masses present and the plain skiagrams were of no diagnostic assistance. The patient died September 6, 1927. The autopsy specimen (Fig. 16) is that of a large papillary carcinoma of the left kidney. Death was caused by bronchopneumonia and renal failure.

CASE VIII.—*Hypernephroma.* J. K., fifty-two years of age, was admitted to the Pennsylvania Hospital January 31, 1928, complaining of right-sided renal colic and massive hæmaturia. He had been perfectly well until the day before admission when he was seized with agonizing pain in the right renal area, followed by hæmaturia. The patient states that he has passed little urine since the onset of his present trouble, but has had great dysuria.

Physical examination revealed signs suggestive of an ancient apical tuberculosis of the left lung, the presence of which was confirmed by the skiagram. There was some tenderness in the right renal area. There was no enlargement of the prostate gland to

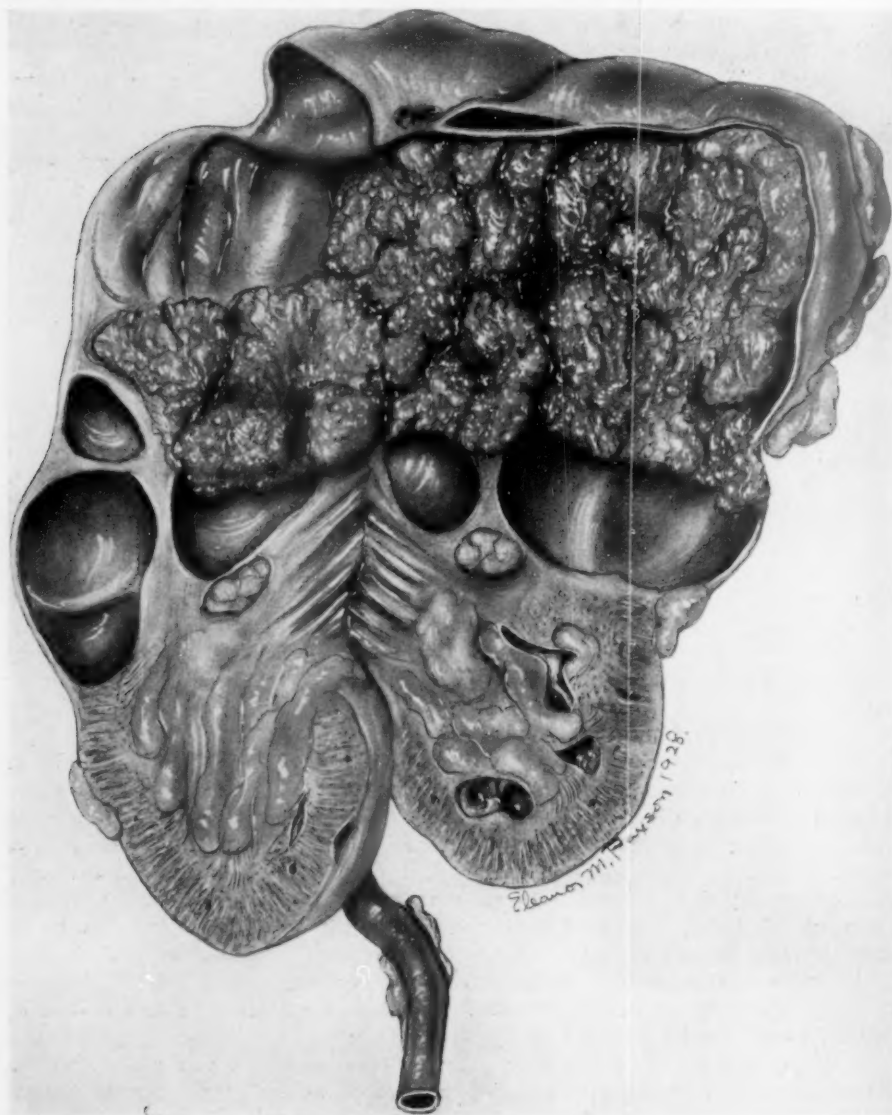


FIG. 16.—(Case VII.) Kidney, the upper portion of which contains a large papillary carcinoma. Note the great thinning of the cortex in the area and the widely dilated calices below the site of the tumor which originated in the true pelvis. The lower pole of the kidney is essentially normal.

rectal examination and no genital nodulation suggestive of tuberculous infection. The bladder was distended with thick blood clots which were removed by catheter irrigation, but only after repeated washings.

Cystoscopic Data.—The initial cystoscopy (February 2, 1928) was not wholly satisfactory, but we succeeded in determining that the right kidney was the source of considerable hæmaturia, and that it secreted only traces of phthalein after thirty minutes.

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FIG. 17.—(Case VIII.) Pyelogram showing marked dilatation of lower calyx with filling defects. The distortion possibly caused by intrarenal clots. At operation, done three months after the pyelogram was made, a hypernephroma was found.

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A pyelogram was made after injecting twenty-five cubic centimetres of sodium iodide solution, disclosing the defect shown in Fig. 17.

A second cystoscopic examination (February 10, 1928) disclosed a moderate median bar obstruction with considerable trabeculation, but only slight residual urine. There were no tumors in the bladder. The right ureteral orifice was slightly cedematous; the left one normal. Clear urine was obtained from the right kidney at first, but after pyelography it became very bloody. The left urine was hazy. The right kidney excreted phthalein in five minutes, the left one in three and one-half minutes. Fifteen-minute collections showed a percentage output of 10 per cent. from the right and 25 per cent. from the left kidney.

A second pyelogram was made which reproduced the deformity disclosed in the first study. Plain röntgenograms were negative for stone or renal deformity. The divided urines were sterile and free from tubercle bacilli.

Discussion.—This middle-aged man had a massive hæmaturia from the right kidney one day before hospital admission. There was the initial symptom. Examination disclosed reduction in function of the involved kidney to about one-half the normal after the bleeding had ceased. The pyelograms showed a pelvic deformity involving chiefly the lower major calix. (Fig. 17.) The latter is obviously dilated. There is perfect regularity of its margins which would tend to rule out an ulcerous cavity or a tumor which had invaded the calix from the parenchyma. There is no evidence here, or in the shadow of the true pelvis, of pressure from without, nor is there elongation with narrowing of any of the calices such as occurs in hypernephromata. It will be noted that there are several light areas which we interpreted as filling defects in the distended calix. The patient refused operation and was discharged. The subsequent course of the case is given us by his physician.

Soon after leaving the Pennsylvania Hospital, he was examined elsewhere and no renal abnormality was found. Three months later he had a second serious hæmorrhage from the kidney. At operation, done elsewhere, a tumor-bearing kidney was removed. The growth proved to be a hypernephroma. The pyelographic defect was probably caused by distention of the calix due to massive hæmorrhage with intrapelvic clotting.

NON-PAPILLARY NEOPLASMS OF THE RENAL PELVIS

Non-papillary carcinomata of the renal pelvis comprise a small excessively malignant group. The collected series presented by Kretschmer⁶ in 1917 included forty-three cases to which may be added five cases reported by Scholl and Foulds,⁷ one each by Keynes⁹ and Wheeler,⁸ and the case (Case II) included in this report.

It is agreed that primary non-papillary neoplasms of the renal pelvis originate from the transitional epithelium, but the parent cells are probably not cells normal to the part, but certain ones which have become squamous in type as the result of metaplasia, or true ectodermic cells representative of developmental inclusions. In the older literature these new growths are described under a great variety of terms, the one most commonly used being pavement-cell epithelioma. Newman¹² claims that only nine properly recorded cases of squamous-cell tumors of the kidney are to be found in the literature up to 1915, while seventeen of Kretschmer's⁶ forty-three collected cases were considered to be epidermoid in type. The recent tendency, as shown in the paper by Scholl and Foulds,⁷ is to classify non-papillary growths as squamous-cell epitheliomata, but it would be advantageous to apply the term epidermoid to those rare cases in which keratinization and pearly body formations occur.

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There would seem to be no question but that chronic irritation is an important predetermining factor in squamous-cell epithelioma of the renal pelvis. This is evidenced by the fact that chronic bacterial inflammation is usually present, and stones as well in about one-half the cases.¹³ Leucoplakia resulting either from the foregoing factors, or arising as a developmental condition, frequently antedates the onset of malignancy, which latter may be found in some instances to develop from the margins of a leucoplakial plaque. These have been the accepted facts for many years and recent writers find no reason to deny them. Of the early pathogenesis of the disease little is known. Few specimens have been subjected to study in the early stage of the neoplasm, partly because the latter is usually asymptomatic at first, but principally, we think, because it is excessively malignant. Wheeler⁸ records the development of a malignant tumor in the renal area following nephrectomy for a supposed uncomplicated calculous pyonephrosis. Reëxamination of the specimen disclosed a small carcinoma involving the lower calix. This illustrates what is, in all probability, a characteristic feature of the disease, namely, early dissemination of the tumor cells. The probabilities are that this usually occurs before the neoplasm has given clinical evidence of its presence.

One type of tumor, as disclosed in the study of operative and necropsy specimens, is characterized by early replacement of the renal parenchyma by tumor cells and fibrosis leading to enlargement, induration, nodulation and dense fixation of the kidney. This type is usually associated with calculi. Early ureteral occlusion with the development of large hydronephroses is typical of the second type, and while parenchymal involvement is retarded in this variety, cure by operation, as in the case of the widely disseminated group, is rarely attained. Early metastasis by way of the lymphatics probably occurs very early in the course of squamous-cell tumors of the renal pelvis whatever gross form the primary growth assumes. Renal dilatation may perhaps account for the pain and the presence of a palpable renal mass in some few instances, but in the majority the former is due to perirenal nerve involvement, the latter to carcinomatous infiltration of the parenchyma. These manifestations of the disease usually denote inoperability.

In seeking to find, in historical data, some hope for earlier recognition of the disease, one meets with cases in which the history of hæmaturia or renal pain long antedates operation. In one of Foulds's⁷ cases there were attacks of hæmaturia sixteen years before operation. In Keynes's⁹ hæmaturia began six years before. Such occurrences are probably to be ascribed to infection, leucoplakia, ulceration and other predisposing causes of the carcinoma. The latter shows a very slight tendency to ulcerate deeply and this together with ureteral closure explains the occurrence of hæmaturia in only 50 per cent. of cases. Tumor implants in the lower urinary tract are said not to occur in the case of non-papillary neoplasms, and it is probable that the tumor shown in Fig. 10 was primarily papillary and at this stage gave origin to the ureteral implant shown in Fig. 9. The diagnosis of squamous-cell, or non-papillary, carcinoma of the renal pelvis would seem to have little practical importance except as the basis of a hopeless prognosis. The lament-

able truth of this is illustrated in Kretschmer's⁶ series of thirty operated cases of which 53.3 per cent. died as the result of operation, and among the survivors the average length of life was seven months and fifteen days. A patient operated upon by Albarran survived four years. Four of the five cases reported from the Mayo Clinic died within three months after operation. The fifth case was apparently well six months after nephrectomy.

No one, as far as we know, has succeeded in making the correct diagnosis of non-papillary tumor of the renal pelvis, nor has anyone succeeded in recognizing the condition as neoplastic early enough to permit complete eradication of the disease by nephrectomy. Foulds⁷ describes the pyelogram in one of his cases as being enlarged and irregular, but the correct diagnosis was not made. In Martin and Mertz's¹³ case the tumor involved the lower portion of the true pelvis and invaded the ostium of the lower calix, but the pyelogram either did not disclose the defect, or the latter, if present, was overlooked since the diagnosis of infected hydronephrosis with multiple calculi was made. It is altogether likely that the pyelogram would disclose pelvic distortion, effacement of an involved calix, or other changes caused by an infiltrating tumor even in the early stages, if the symptomatology indicating the necessity for such studies arose, or if calculus cases and chronically infected kidneys were subjected routinely to pyelographic study. That early diagnosis would lead to improvement in operative results is probable, but at the present time the results obtained by operation justify the conclusion that non-papillary carcinoma of the kidney is a fatal disease.

PAPILLARY NEOPLASMS

Of the 181 cases of primary neoplasms of the renal pelvis collected by Meltzer³ in 1926, 144 (76.6 per cent.) were papillary in form, the majority of them being papillary carcinoma. We have no means of knowing how many of the latter group were primarily benign, but the probabilities are that a considerable number began as simple papillomata. This is indicated by the history in many instances of hæmaturia long antedating operation.

Papillary tumors as a class are less malignant than the non-papillary type, but unlike the latter, they give origin in 70 per cent. of cases to tumor implants in the ureter and bladder. The papillary tumor may exhibit extraordinary malignancy and, in rare instances, an apparently benign papilloma becomes the source of widespread, rapidly growing metastases. In most instances, however, both parenchymal invasion and metastatic dissemination occur comparatively late in the disease. Marked malignancy characterized the behavior of the growth in thirty-seven of Meltzer's³ collected series.

Hæmaturia, often massive and sometimes painless, occurs in at least 90 per cent. of cases and is likely to occur comparatively early. The tumor shown in Fig. 2 must have been present for some time, but was the source of an initial hæmaturia only one month before operation. The hæmaturia varies in degree, but truly massive renal hæmaturia in the absence of renal enlargement is very suggestive of papillary neoplasm.

PRIMARY NEOPLASMS OF RENAL PELVIS

Renal colic caused by the passage of clots, which are sometimes worm-like, or by pelvic blockage due to a pedunculated growth, is a frequent symptom. Fixed, boring renal pain is highly suggestive of advanced carcinoma.

Palpable renal enlargement, with or without fixation of the kidney, when due to parenchymal involvement indicates inoperability, but it is sometimes caused by hydronephrosis, which may be primary or secondary.

Intermittent hematuria is a rare occurrence and is not always due to papillary tumor.

Fortunately, gross hematuria is a frequent symptom of papillary neoplasms of the kidney pelvis. The only dependable means of diagnosing these new growths would seem to be urographic demonstration of pelvic distortion in the routine search for the cause of renal hematuria.

Differential Diagnosis.—It may be assumed that the clinical diagnosis of an intrapelvic neoplasm is impossible. Large renal tumors associated with gross hematuria are usually hypernephromata, but both the recognition of neoplasm as the cause of renal symptoms and the differentiation between the various types of renal new growths are largely dependent upon urography. The differential diagnosis between papillary tumors, essential hematuria, early renal tuberculosis, bleeding nephritis, angiomas, hydronephrosis, and other bleeding lesions of the kidney, is likewise dependent largely upon pyelography. The clinical history, physical findings, examination of the divided urine, differential renal functional studies, and various laboratory tests are useful diagnostic adjuncts. Parmenter¹⁴ has again called attention to the occasional presence in the urine, especially in the case of papillary growths, of tumor cells, but the method has little practical value.

Little can be accomplished in the diagnosis of renal lesions when the kidney is closed and the bladder free from pathology. The presence of a papillary growth in the bladder associated with unilateral hematuria, or closed kidney, should suggest the probability of a primary papillary growth in the kidney pelvis. Whenever possible, the upper urinary tract should be studied when papillary tumors are found in the urinary bladder, and ureterography is definitely indicated, especially in the case of the closed kidney, when this occurs in association with a vesical neoplasm.

The most important group of cases from the diagnostic standpoint comprises those with renal hematuria in the absence of renal enlargement or vesical implants. The presence of infection, or stone, does not remove the possibility of papillary tumor which is complicated by stone in 7 per cent. of cases, and often by simple infection. Massive hemorrhage from a stone-bearing kidney is always suggestive of a complicating neoplasm. In rare instances, renal tuberculosis causes intermittent gross hematuria, the attacks being separated by many years. In such cases the infection often fails to show the usual tendency to involve the lower urinary tract. We recently removed a tuberculous kidney from a man who had an initial hematuria thirteen years before operation, a second attack eight years before. Following the second attack, we examined the patient but failed to recognize the

condition. The examination was thorough except that pyelography was omitted. The divided renal function was normal, and guinea-pig inoculations proved negative. We suspected tuberculous infection of the kidney but could not demonstrate it. Several months ago, this patient returned with a third attack of hæmaturia. Examination disclosed the presence of a normal bladder and a functionless left kidney. Tubercle bacilli were found in the bladder urine. The pyelographic medium failed to enter the kidney pelvis, but we succeeded in demonstrating the presence of a stricture at the uretero-pelvic junction. The kidney at operation was found to have a reduplicated pelvis, the upper half being hydronephrotic, the lower half tuberculous. In the event of failure to find the tubercle bacilli in this case, the diagnosis of papilloma of the kidney with carcinomatous transformation would not have been illogical.

In very early cases of renal tuberculosis with gross hæmaturia, insignificant pyuria, a normal bladder and no demonstrable tubercle bacilluria, the differentiation from papillary neoplasms is almost wholly dependent upon the demonstration of cavitation in the apices of the pyramids. Contrary to the accepted opinion, we have found little renal dysfunction measurable by the dye tests in very early renal tuberculosis.

Papillary tumors of the renal pelvis may or may not cause diminution in the function of the involved kidney, and the kidney which bleeds without evident cause, the so-called essential hæmaturia, may or may not show dysfunction, so that in the differentiation of these conditions, pyelography, while not infallible, is of paramount importance.

Pyelography.—The mechanics of neoplastic distortion of the renal pelvis comprise, chiefly, pressure from without, traction on the calices, distention and distortion due to neoplastic pressure and ulceration from within, dilatation of part or all of the pelvis due to urinary obstruction offered by the tumor, and various degrees of obliteration of the pelvis by neoplasms originating either within the pelvis, or invading this cavity from without. Parenchymal tumors, especially the hypernephromata, which are more or less encapsulated, usually cause pressure deformities of the true pelvis long before actual invasion of this cavity occurs, and cause at the same time elongation and narrowing of the calices through traction and pressure. The resulting spider-leg deformity is the most characteristic urographic picture caused by a renal neoplasm.

In some instances parenchymal neoplasms, especially the rare tubular carcinomata, also hypernephromata originating in the medullary portion of the kidney, cause early obliterations of one or more calices, and, through early invasion of the true pelvis, cause filling defects which cannot be differentiated in the pyelogram from those caused by primary intrapelvic growths.

It would seem to be impossible for a parenchymal neoplasm to cause the uniform distention of a calix shown in Fig. 17; deformities like this are usually caused by pressure from within.

Neoplastic foreign bodies such as large invisible stones, or blood clots,

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may cause filling defects which cannot be distinguished from those caused by intrapelvic tumors, and, as mentioned above, no one has made the urographic differentiation between papillary and non-papillary new growths.

In view of the difficulties encountered generally in pyelographic interpretation one might expect some limitations in the diagnostic value of the method in the case of intrapelvic tumors. We cannot agree with Young and Waters,¹⁵ however, who hold that with the exception of pyelography in the case of hypernephromata, efforts to distinguish the different types of tumor are useless since there are no dependable criteria, although a study of the reported cases would seem to justify their conclusion. Prior to March, 1924, only five cases of intrapelvic tumor were subjected to pyelographic study.¹¹ Since that time, however, papillary tumors have been correctly diagnosed by Meltzer,³ Angle,¹⁶ Kretschmer,¹⁷ Graves and Templeton,¹⁸ Day,² Bothe,¹⁹ Thomas and Regnier,¹¹ Scholl,²⁰ and others.

Seely²¹ reports a case of papillary tumor in which the pyelogram was normal, and states that "pyelography has not proved useful". In one of Thomas and Regnier's¹¹ cases the pyelogram made four years before operation was normal, and Bugbee²² succeeding in demonstrating a filling defect some months after an initial pyelogram failed to show distortion of the pelvis. In another of Thomas and Regnier's¹¹ cases, bilateral pyelograms made five months before operation were negative. These cases illustrate the great folly of making the diagnosis of essential hæmaturia on the basis of an initial normal pyelogram.

Kretschmer¹⁷ reports misinterpretation of a filling defect in the pyelogram in a case in which operation failed to disclose a neoplasm.

In some instances pyelographic misinterpretation has been due to associated stone shadows, while in several reported cases a papillary growth contained in a hydronephrotic sac failed to reveal itself as a filling defect.

Notwithstanding the difficulties and uncertainties of urographic interpretation, we agree with Braasch²³ that in the majority of cases the diagnosis of intrapelvic tumors can be made quite certain by means of pyelography. With increased experience the recognition of defects caused by these neoplasms will be made more frequently and with far greater certainty. There are no characteristic deformities demonstrable in the case of intrapelvic tumors comparable with those caused by hydronephroma, but in the majority of cases one finds an irregular filling defect of the true pelvis associated with dilatation of some of the calices and usually those situated at the upper pole. (Fig. 6.) There may or may not be obliteration of certain calices or regular distention due to pressure from a neoplasm originating within the calix, but the elongation and narrowing of one or more calices with effacement of the terminal cupping so characteristic of hypernephromata is never caused by primary growths of the renal pelvis.

Moderate-sized papillomata situated in a capacious pelvis at a point removed from the ostia of the calices and ureter cause only a circumscribed filling defect comparable in size with that of the tumor.

Tumors originating from the pelvic walls near the ostium of a calix may cause dilatation or obliteration of the cavity of the calix. The tumor if situated at the uretero-junction causes hydronephrosis, but a filling defect representative of the tumor is often demonstrable.

Large papillary growths may fill the true pelvis and calices almost completely, the small remaining space between the tumor masses being represented in the pyelogram by small, irregular patches and streaks.

Figures like the foregoing are seldom caused by lesions other than papillary growths of the renal pelvis.

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PRIMARY EPITHELIOMA OF THE VULVA

AN ANALYSIS OF SEVENTY-ONE CASES *

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MUCH has been written on this subject, but most of what has been written consists of single case reports or analyses of collected cases from the literature with inadequate data. Morgagni, 1751, reported the first case of epithelioma of the vulva. Mayer, 1866, presented the first clinically significant work on the subject in a report of eight cases. Dittrick, 1905, reviewed 135 cases, specimens from seventy-three of which were studied histologically. Teller, 1907-1908, reported thirty-nine cases from one clinic, but the clinical data seem incomplete inasmuch as less than half of the cases were traced. Rothschild, 1912, reviewed 331 reported cases of malignant growths of the vulva; in thirty-nine of these the pathologic histology of the glands was studied.

Histologic study was made in all of the cases in my series and all of the patients except six were traced by follow-up letters; the information was obtained from the patient, the home physician, a relative, or from the records of The Mayo Clinic. Of the six patients who were not traced, four left the clinic with lymphatic involvement. The home physician of one reported that there was no evidence of recurrence three years and eight months after the operation. Thirty-one of the seventy-one cases have been reported by Broders in connection with epithelioma of the genito-urinary tract.

Compared with the frequency of carcinoma of the internal genital organs in women, primary epithelioma of the vulva is rare. According to Schwarz the incidence was 1.38. Virchow reported an incidence of 1.35 or 1.40. Gurlt gave the incidence of 1.48, and Taussig as 1.20. According to Brady, statistics from Johns Hopkins Hospital show nineteen cases of epithelioma of the vulva to 756 cases of carcinoma of the cervix, or a ratio of 1.39.7; however, two of the nineteen cases were epithelioma of the urethra. In The Mayo Clinic the ratio based on histologic study was 1.25.

The disease is distinctly one of advanced life, the patients as a rule being women who have reached the late sixties or seventies and even eighties. Youth, however, is not exempt. The oldest patient of whom we have any record is in a case reported by Dittrick in which the diagnosis was made at the age of ninety.

On the other hand, West, Schwarz, Lutzenberger, Merz, Björkquist and Fritsch reported cases in which this condition was observed in the second

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and third decades of life. Indeed, Le Fleur and Loörich claimed to have seen several cases in which the diagnosis was made in the first decade and Biatrix, who reported the case of the youngest patient on record, placed the early age limit at eighteen months. However, the authenticity of these cases cannot be accepted without reservation, inasmuch as the diagnosis of cases reported was not always fortified by histologic examination. Dittrick found the greatest frequency in the seventh decade; so also had Teller, Schwarz, Backer, Rothschild and Goldschmidt. Winkel, in a series of fifty-four cases, noted the greatest frequency in the sixth decade.

In the series studied here the cases were divided as follows:

Age, years	Number of cases	Per cent.
21 to 30	1	1.40
31 to 40	7	9.85
41 to 50	12	16.89
51 to 60	20	28.06
61 to 70	19	26.75
71 to 80	10	14.08
81 to 90	2	2.81

The youngest patient was twenty-seven and the oldest, eighty-six.

Diagnosis.—Early diagnosis is of paramount importance. Patients have symptoms early, but apparently from false modesty they do not seek medical aid until late. In this series, the average duration of the actual lesion before the patient came to the clinic was one and forty-nine hundredths years. In nine cases the lesions were inoperable, and four of these patients had not consulted a physician.

The differential diagnosis of primary epithelioma of the vulva and metastatic growth is of vital importance. Metastasis to the vulva is always possible and is not infrequent in cases of primary malignant growth of the ovary, fundus, cervix, vagina, and urethra. A thorough general examination, therefore, is most important. In the early diagnosis tuberculosis and syphilis are next to be eliminated. One patient in the present series was treated first for syphilis, later for tuberculosis, and finally the condition was diagnosed as epithelioma and was inoperable.

In tuberculosis or lupus the disease tends to heal with cicatrization as the ulcer advances, and often with considerable hypertrophy of the surrounding tissue. Tuberculosis occurs in younger patients and the lesion does not have as great a tendency as epithelioma to bleed on manipulation.

When the epithelioma is in the stage of ulceration it may be confused, especially with chancre, with the secondary or tertiary lesions of syphilis, and with chancroid (soft chancre).

Chancre is distinguished by the peculiar type of ulceration, by the brownish color and by the definite regularity and circular arrangement. The ulceration is rapid, not painful, and does not show a tendency to spread. The lymphatics are involved early. The soft chancre or chancroid does not resemble very much the ulceration of true carcinoma. It differs by its premature appear-

214 cases, noted that nineteen were nulliparas and six were virgins. In fifteen cases reported by Taussig six patients had not had children and three had never been married. In the present series, three patients were single, three had never been pregnant, and five had not had children; in five instances the number of pregnancies and children was not stated.

Trauma is emphasized in the literature as a cause of this condition, but it would seem that this impression is gained largely by the report of a small group of cases, which has become notorious by mere repetition, rather than by the frequency of occurrence.

In my series there was a definite history of trauma in only one case. In



FIG. 2.—A peri-ureteral epithelioma.

this case the patient, while plowing, was thrown against the edge of the seat, bruising and breaking the skin of the vulva. Instead of healing, the lesion increased in extent and bleeding and pruritus soon followed. Even in this case the patient complained of pruritus for seven years preceding the trauma.

Other conditions are concerned in the lowering of local resistance and in the maintenance of chronic irritation. The most common of these is pruritus. The question whether this is an initial

symptom or an etiologic factor is not yet settled. It would seem in those cases in which the patient has suffered for several years from pruritus that has caused considerable excoriation, abrasion and resultant pigmentation, and in which epithelioma has developed later, that it is only fair to suppose that the pruritus was at least an indirect factor in the production of the epithelioma. On the other hand, in those instances in which the irritation has preceded the tumor by a few months only, it should probably be regarded merely as an early symptom. Practically every writer on this subject regards pruritus as a precancerous condition. Veit knew of it and wrote that great value must be attached to the complaint of pruritus. Franke believes that either the senile or diabetic form of pruritus may be followed by epithelioma. Frankl believes there is no doubt but that pruritus may be considered in causal relationship. Rothchild believes it is likely that epithelioma develops on the base of the pruritus, for pruritus is often well advanced when there

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ance and rapid evolution. The lymph nodes suppurate almost from the first. The lesion has a sharp, punched-out appearance with undermined edges. When inflamed, the venereal wart can scarcely be distinguished from epithelioma. Secondary and tertiary syphilitic lesions which sometimes localize in this region are multiple and in their large variety rarely have the true appearance of a tumor. The Wassermann reaction is an aid to diagnosis.

Condylomas may be mistaken for epithelioma, but absence of pain and ulceration is important. They may bleed easily if inflamed. Usually, evidence of gonococcal infection can be found.

Urethral caruncle may simulate malignancy, but it is never indurated and it arises definitely from the mucous membrane of the urethra.

With chronic infection of the Bartholin glands there may be a tumor or cyst. There is usually a history of preceding abscess, and the tumor gradually gets smaller, is freely movable in the tissues, and is not hard.

In leukoplakia the growth is slow. There is constant absence of adenopathy; however, sometimes there is transformation of this lesion into epithelioma. When there is a nonulcerated tumor, one thinks of a simple papilloma; however, at the beginning the epithelioma has a similar appearance. The difference lies in that the papilloma does not rest on an indurated base and has more or less tendency to pedunculate. In any case of the slightest doubt it is always expedient to do a biopsy.

Etiology.—In speaking of the etiology, the cause of cancer in general will not be considered, but only those conditions which are commonly believed to predispose to its appearance on the vulva. The principal factors, as usually given, are mechanical injuries and the various forms of chronic irritation.

When one compares the frequency of trauma to which the external genitals of the female are subjected at childbirth and coitus with the rarity of epithelioma of the vulva, it readily appears that trauma plays only a minor part in the cause. Lutzenberger, in his series of 105 cases, noted that nineteen women were either nulliparas or virgins. Goldschmidt, in a series of



FIG. 1.—Epithelioma of the right labia majora.

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is no sign of the epithelioma. Goldschmidt considers pruritus to be symptomatic in 32.4 per cent. of his cases. Schwarz observed it ten times in his series of twenty-three cases of epithelioma of the vulva. In the series at Johns Hopkins Hospital it was present in 50 per cent. of the cases. In my series twenty-nine of the seventy-one patients gave a history of preëxisting pruritus as follows: One for twenty-five years, four for twenty years, two for sixteen years, one for fifteen years, one for thirteen years, two for nine years, one for seven years, four for three to four years, six for one to two years, four for six months before the appearance of the growth, and three for no definite time stated; one of these specified for "many years".

Whether pruritus is an etiologic factor or merely an early symptom, intense and obstinate itching is frequently the forerunner of malignancy and whenever such a symptom is present a thorough examination should be made.

In most essays on the subject some mention is made of leukoplakia in this connection. Leuko-

plakia is a chronic inflammation characterized by whitish plaques rather than by a general atrophic process involving the entire vulva. Mention is made of kraurosis in the same fashion. Veit and Szasz believe that the two are identical. Histologically the lesions in leukoplakia are in the epidermis. About the first one to refer to leukoplakia as an etiologic factor in epithelioma was Bex, who in 1887 wrote that leukoplakia of the vulva and vagina are potentially epithelioma. Mayer has demonstrated a case in which epithelioma began in the epithelial thickening in the centre of one of these patches of leukoplakia. Schwarz reported a case in which an epithelioma developed on the site where one year previously he had noted a leukoplakial patch about three centimetres in diameter. In the present series leukoplakia alone existed in one case. In another case leukoplakia and kraurosis both appeared, and in three cases kraurosis alone was present. Because epithelioma has been known to develop on areas of leukoplakia, these areas should be watched carefully and with prophylaxis in mind, or on the first suggestion of malignancy they should be widely excised.

One must also consider the origin of epithelioma on benign growths, such as warts, atheromas and papillomas. Of the papillomas two were reported by Horn, two by Basset, and one by Winckel. In the present series epithelioma was found to have its origin at the site of a mole.

It is probably significant that, of the seventy-one patients in this series,

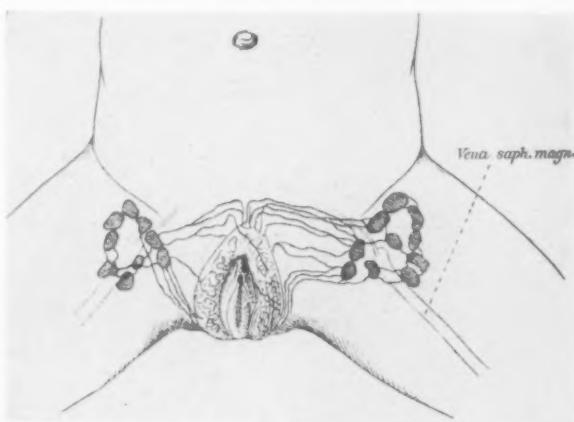


FIG. 3.—The direction of the collecting trunks of the lymphatic network of the vulva (Bruhns).

sixty-two were beyond the age of menopause which may be considered as forty-seven years. Another patient had experienced artificial menopause following total hysterectomy for uterine myomas. What the absence of the ovarian secretion has to do with malignant conditions of the external genitals is speculative.

In twelve instances there was a history of malignancy in the immediate family, affecting parents, brothers, or sisters, and in one instance, the grandmother. In one instance, according to the home physician who had taken

care of all of them except one, three sisters of four had malignant growths of the vulva and their father had died from cancer.

Signs and Symptoms.
—Epithelioma of the vulva may exist for some time without causing any symptom, and often the tumor is discovered only accidentally.

Twenty-nine patients complained of pruritus, and this to them was the first indication of the disease.

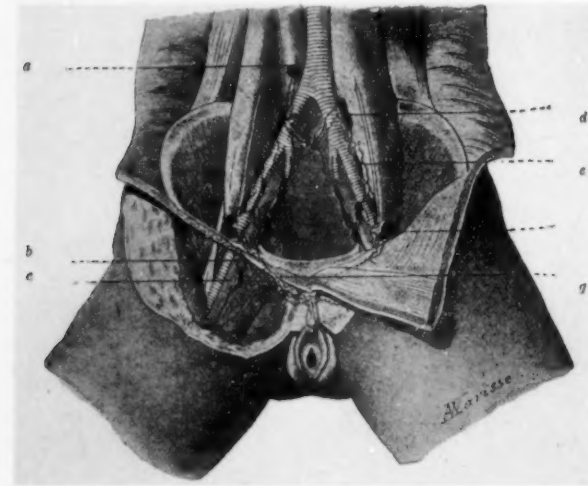


FIG. 4.—Lymphatics of the clitoris (Cunéo and Marcille).

ease. The next most frequent sign of the disease is the new growth itself with its ulcerating tumefaction and hardness.

Pain is a late symptom. As long as the tumor has not broken through and ulcerated, pain does not seem to be present. The pain increases in severity as ulceration advances. It is described as sharp, piercing, darting, pricking, lancinating, stinging, smarting or burning, and comes on in paroxysms which are worse at night. It frequently radiates into the hip and down the thighs, or it may be referred to the lower part of the abdomen or the vagina. Walking, or even sitting, is soon accompanied by great distress and the patient becomes bedridden. As soon as there is ulceration there is a discharge, at first merely from the mechanical irritation of the tumor. As a rule the patient does not seek medical assistance until there is ulceration. Thirty-four of the patients had ulceration when first examined. As time goes on the discharge becomes more profuse. At first it is whitish, mucoid and watery, but later, as the tissue degenerates, it becomes fetid, yellowish, and purulent. It is tinged with blood from time to time, but seldom is there profuse hæmorrhage. Hæmorrhage was one of the complaints in eleven instances. Painful coitus was the first complaint in one case. Urination is often interfered with, especially in cases in which the growth is at the clitoris or is peri-urethral. The urine trickles over the

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ulcerated surface and causes smarting, burning and scalding pain on voiding. In many cases there is frequency. Urinary incontinence and difficult micturition may also follow as a result of the infiltration of the surrounding tissue by the new growth. Often the first sign of the disease is the presence of metastatic nodules and symptoms arising from these.

Secondary anaemia and cachexia are progressive with the course of the disease. There is much loss of strength, failure of appetite, the patient gets no rest, and death comes from exhaustion. Other complications which can cause death are involvement of the bladder, resulting in cystitis and ascending urinary infection, phlebitis, thrombosis of femoral vessels with resulting lymphedema of the legs, chronic septicaemia and, rarely, frank hæmorrhage. In the present series three patients died from extensive lymphedema of one of the legs. Usually the end comes from progressive failure and exhaustion before the foregoing complications set in.

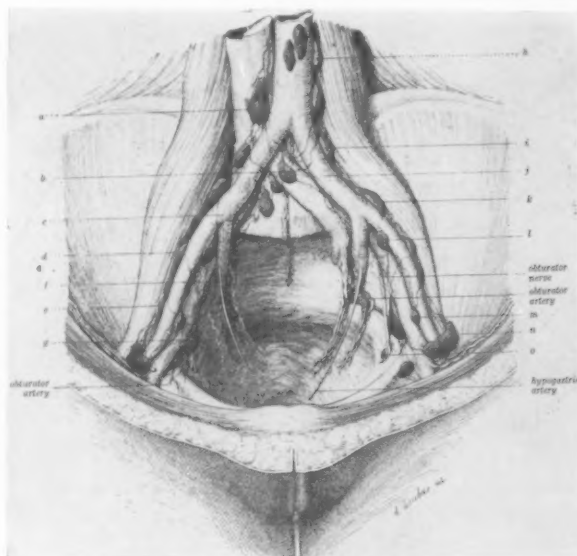


FIG. 5.—The iliopelvic glands (Cunéo and Marcille).

Associated Lesions.—

In this connection there is probably not much to be said. Mention already had been made of pruritus, leukoplakia, kraurosis and benign growths such as warts, atheromas and papillomas.

Two patients had had syphilis long before the epithelioma of the vulva appeared. In one of these cases there was also a history of gonorrhœal infection followed by venereal warts.

Diabetes mellitus was observed in two other cases. In one case the disease was of seven years' standing and was associated with pruritus of the vulva. In the other case the diabetes was accompanied by vascular changes, was of shorter duration and was not associated with pruritus. One patient had pin-worm infection of two years' duration associated with severe pruritus of the vulva and anus. It would appear, therefore, that the abnormal associated conditions are relatively insignificant and are not characteristic of the disease, but rather are the same conditions one would expect to observe with equal frequency in a group of women in the later decades of life.

Anatomy of the Lymphatics.—In view of the important part played by the lymphatics of the vulva in the spread of carcinoma a brief sketch of the anatomy of the lymphatics is presented.

The oldest significant work on the lymphatics was done by Sappy in 1874 working with mercury injections. This work was continued by his pupil, Poirier, who, in 1892, advocated injection of Prussian blue, adopting Grotas' process. Working with Poirier were Cunéo and Delamere, the latter primarily an histologist. Together they again undertook the study of the lymphatics of the entire body. Their work on the lymphatics of the vulva was an authoritative contribution and more recently has been confirmed by Cunéo and Marcille and Bruhns and may be presented as follows:

The lymphatics of the vulva arise from a network, the extremely close meshes of which are superimposed in several planes. This network covers the fourchette, the urinary meatus, the vestibule, the prepuce of the clitoris, the clitoris, the labia minora and

the internal surface of the labia majora. It is so loose and close throughout that when it has been well injected it presents at first sight merely an ashy-gray appearance. To distinguish the innumerable silvery filaments of which it is composed a magnifying glass must be used. On the external surface of the labia majora the network composed of smaller and larger branches becomes sufficiently distinct to be recognized by the naked eye.

From the periphery of this network of origin run the collecting trunks. The direction of these trunks varies according to their points of origin. Those which come from the anterior third of the vulva run directly upward and forward toward the mons veneris; there they turn sharply and run transversely toward the superficial

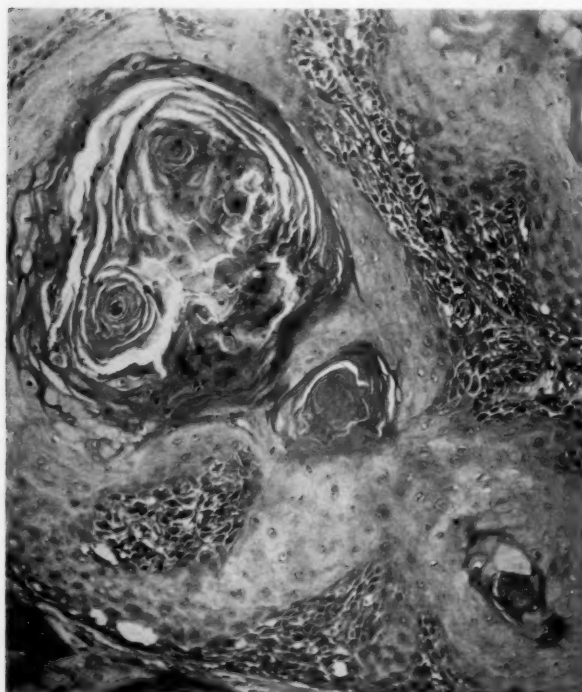


FIG. 6.—Epithelioma, graded 1 (x 75).

inguinal lymph nodes. The trunks which come from the posterior two-thirds are directed upward and outward and directly reach their terminal nodes.

The inguinal nodes consist of two groups: the superficial and the deep. The superficial are found in the deep layers of the superficial fascia. The number varies from ten to twenty. For convenience they are grouped into superior internal, superior external, inferior internal and inferior external groups.

The majority of the lymphatics of the vulva terminate in the nodes of the superior-internal group. Some of them may end in the inferior-internal group. It is even possible, although much more rare, for some of these vessels to reach a node belonging to one of the two external groups.

When injecting one-half of the vulva, the mass may frequently be seen to reach the nodes of the opposite side. Participation of those nodes in the injection may take place by a double process. Sometimes it is effected by continuity in the median line of the network of origin of the two sides of the vulva; at other times it is due to the fact that some of the collecting trunks cross the median line and end in the inguinal region of the opposite side.

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The lymphatics of the clitoris deserve special mention. In fact, although the lymphatics of the prepuce of the clitoris pass into the superficial inguinal nodes, like the other lymphatics of the vulva, this is not the destination of the lymphatics of the glans of the clitoris. The latter lymphatics are in general arranged identically with those of the lymphatics of the glans in the male. The network of origin gives rise to several collecting trunks which run on the dorsal surface of the clitoris and reach the front of the symphysis; they anastomose at this point and form a parasymphysial network in which some small nodes may be seen. From this plexus run two sets of collecting trunks. One of these vessels runs in the inguinal canal and ends in the external retrocrural node. This vessel usually is placed beneath the round ligament and may show in its course a small interrupting glandular nodule. Other trunks run toward the crural canal and end in a deep inguinal node, in the gland of Cloquet, and in the internal retrocrural node.

The research on the lymphatic vessels of the Bartholin glands presented a hard problem. The results are not absolutely true and unquestionable. Bruhns always found only injection of the inguinal nodes, and the lymph channels never led to the pelvic nodes. The trunks leading to the inguinal nodes corresponded with those seen during the injection into the labia.

Attention is called to the fact that the network of lymphatics of the vulva, which is tributary to the inguinal nodes, is distinctly separated by the hymen from the vaginal lymphatic plexus, which is tributary to the pelvic nodes. This separation is especially marked in children in whom vaginal lymphatics do not terminate in the inguinal nodes. As shown by Poirier, and later by Bruhns, injections within the hymenal septum in children pass to the lymph vessels going to the pelvic nodes; whereas, injections applied on the septum next to the vulva reach the lymph vessels going to the inguinal nodes. In adult women it is possible for injections made at the level of the lower portion of the vagina to reach the inguinal nodes, not through direct collecting channels, but by way of numerous anastomoses which unite the network of the vagina with the network of the vulva.

Involvement of the lymph nodes in the tissue surrounding the rectum seems probable, but has not as yet been established positively.

The efferent vessels of the superficial inguinal nodes end in the deep inguinal or in the external iliac nodes. The efferent vessels which terminate in the deep inguinal nodes are the least numerous. They come especially from the nodes of the two lower groups. The efferent vessels which terminate in the pelvis are much more important; they vary in number from eight to twelve and are always of considerable calibre.

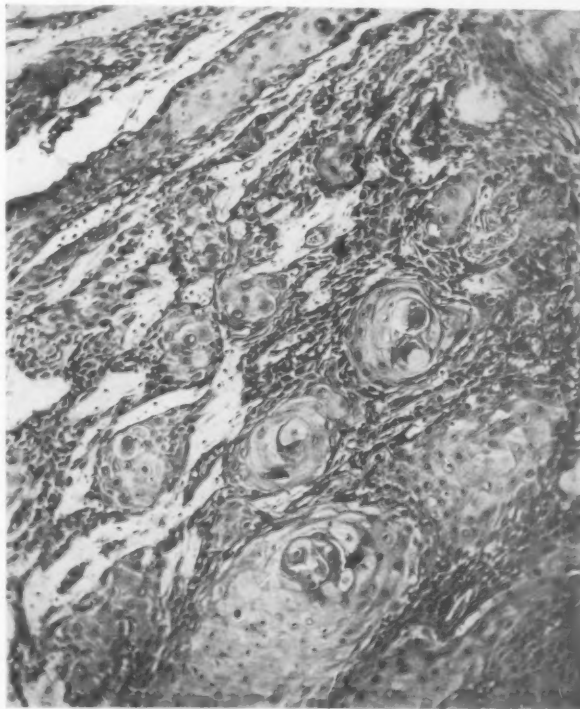


FIG. 7.—Epithelioma, graded 2 (x 75).

The deep inguinal nodes are less important than the superficial nodes. They vary in number from one to three and usually are not large. They are continuous above with the internal chain of the external iliac nodes. The superior node of the group occupies the external part of the crural canal and protrudes through the crural septum into the pelvic cavity. French writers call it the gland of Cloquet, whereas German writers call it the gland of Rosenmüller.

Aside from receiving some of the efferent vessels from the superficial inguinal nodes, the deep inguinal nodes receive efferent vessels, also from the deep lymphatics which accompany the femoral vessels. The efferent vessels of these nodes penetrate

into the pelvic cavity and almost all terminate in the internal and external retrocrural nodes.

Although the lymphatic nodes of the pelvis are continuous, without line of demarcation from the abdominal nodes, they are divided for convenience into two groups. These groups are separated by an imaginary horizontal line passing through the bifurcation of the aorta, into an inferior or ilio-pelvic group and a superior or abdomino-aortic group.

The ilio-pelvic nodes have a paravascular arrangement enabling them to be divided into three groups, namely the external iliac, the hypogastric, and the common iliac.

The external iliac nodes grouped about the external iliac vessels are regarded as forming three chains more or less continuous, external,



FIG. 8.—Epithelioma, graded 3 (x 75).

middle and internal. The lowest node in each chain is called retrocrural. The external iliac chains receive lymphatics coming from the inguinal nodes. The external and internal chains receive these vessels directly. The middle chain receives them only after they have been interrupted in the external and internal retrocrural nodes.

Each node belonging to these different chains sends its efferents to the node above it, so that the highest node of the chain continues the lymphatic circulation of those placed below it. Ultimately they terminate in the nodes of the common iliac group.

The internal iliac or lymphatic nodes receive efferents from all the pelvic viscera. The efferent vessels terminate in the middle part of the common iliac nodes.

The common iliac nodes, grouped around the common iliac artery, also are divided into external, middle, and internal groups. The internal group lies in front of the body of the fifth lumbar vertebra or on the disk between this and the sacrum and is sometimes called the group of the promontory. The external and middle group do not receive any vessels emanating directly from the neighboring organs. On the contrary they form the terminus for the numerous and large efferents of the external iliac and internal iliac lymphatic nodes. The internal group receives vessels from most of the pelvic

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organs. The efferents of the three groups converge toward the inferior part of the lateral aortic chain of the corresponding side. All the ilio pelvic lymphatics finally end, therefore, in the two right and left juxta-aortic chains.

The practical application of the anatomic data is clearly and concisely summarized by Crossen as follows:

1. From carcinoma of the labia majora or minora all the lymphatic distribution in the early stage is likely to be to the inguinal nodes.
2. This distribution may extend not only to the side on which the lesion is situated but also to the opposite side; hence the nodes on both sides should be removed.
3. In carcinoma of the clitoris early distribution to the glands inside the pelvis is probable.

Metastasis.—Metastasis is often noted in the neighboring areas of the vulva or even in the perineum. The infective material is carried through the lymphatics, although when metastasis is in the perineum the cells have travelled against the lymphatic current. Tausig recorded a case of peri-urethral epithelioma with implantation metastasis in the left gluteal region. In the present series in one case there was perineal infiltration with loss of rectal sphincter control. In another case there were two superficial implants on the left buttock, a short distance from the anus.

Involvement of the adjacent skin and mucosa of the opposite labium results in the so-called contact epithelioma. Cases of this nature have been cited by Schwarz, Hildebrandt, Zweifel, and Kelly. In the present series a malignant new growth on the opposite labium was noted in three cases on first examination. In two other cases contact growths were noted on the second examination, one six months, and the other eight years following the previous operation. In the latter case, it is likely that the second lesion was a new and independent growth and not recurrence. Franke pointed out that the origin of these contact growths is due to the invasion of the carcinoma through the blood or lymphatic vessels, mechanical irritation of the tumor itself, lowering of the local resistance from the secretion of the ulcerated tumor, direct transplantation of masses of cells, and the implantation of the organisms if there are organisms in the carcinoma.

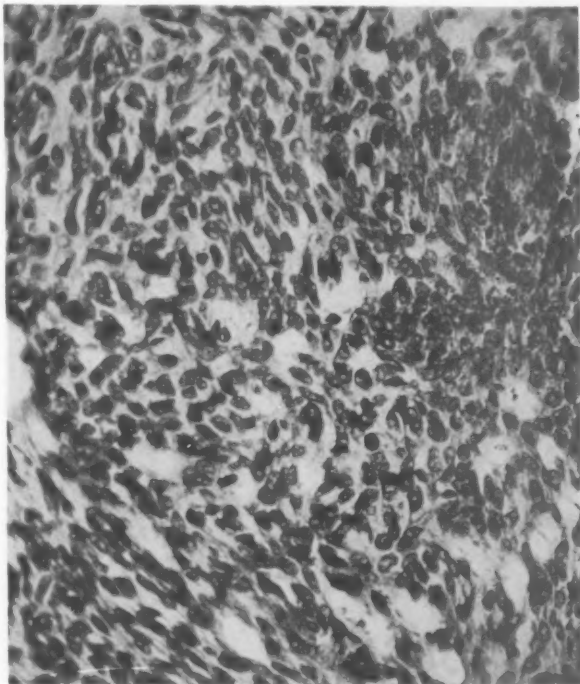


FIG. 9.—Epithelioma, graded 3 (x 325).

Special importance is attached to early involvement of the regional lymphatics. Involvement of the external inguinal nodes represents the first stage; of the deep inguinal nodes, the second stage; and of the external iliac; hypogastric and common iliac nodes, the third stage of carcinomatous invasion. The inguinal nodes may or may not be enlarged. If they are enlarged it is due to hyperplasia or malignant involvement. Lymphatic hypertrophy is usually early in cases in which the primary tumor shows early ulceration. The differential diagnosis is not reliable except that made by extirpation and microscopic study; and even by the latter method one can study sections which may be negative for malignant cells, and yet in certain parts of the nodes there may be malignant cells.

Dittrick, in a review of 135 cases, found that in thirty-three cases, clinically there was involvement of the nodes, and in seven of these the diagnosis was confirmed by microscopic examination. In thirty-six additional cases the nodes were enlarged, but in twelve of these the condition was due to hyperplasia of the lymphoid tissue without any carcinomatous invasion. In several cases there was slight enlargement of the nodes before excision of the ulcerated tumor, and with the removal of the growth swelling of the nodes subsided.

Schwarz, in twenty-three cases, noted glandular hypertrophy in eleven cases; in twelve, none. In the eleven cases, extirpation and microscopic study disclosed malignant involvement in five cases and inflammatory hyperplasia in the remaining six.

In the cases reviewed by Rothschild a microscopic study of the nodes was made (Table I).

TABLE I.
Results of Microscopic Study of Lymph Nodes in Thirty-nine Cases of Primary Carcinoma of the Vulva

	Cases	Carcinomatous		Noncarcinomatous	
		Cases	Per cent	Cases	Per cent
Microscopically enlarged	32	15	46.9	17	53.1
Questionable whether enlarged or not	3	2	66.6	1	33.3
Not enlarged	4	2	50.0	2	50.0
Total	39				

Schultze, in a review of 114 cases, found that the infiltrated nodes from twenty-one cases were studied microscopically. Of these cases malignant involvement was found in ten and was not found in eleven.

In my series of cases the clinician reported enlarged inguinal nodes in thirty cases. Nine of these were inoperable. In three others nodes were not removed. In the remaining eighteen cases the nodes were removed at the first operation. Carcinoma was found in fourteen of the cases. Nodes were also removed in fifteen other cases at the first operation, but in these there

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was no hypertrophy. Carcinoma was found in only three of the fifteen cases. The clinician had noted that nodes were not enlarged in two of these three cases. In the third case mention of nodes was not made.

Through the communication of the inguinal with the ilio pelvic nodes, metastasis to these nodes is easily possible. In the present series pelvic involvement was evident in four cases, and in another case there was a large retroperitoneal mass and recurrence when the patient returned following operation.

In its continued development, the carcinoma encroaches on the pelvic connective tissue, especially on the retrovaginal and vesicovaginal septum.

The pelvic bones, more particularly the descending pubic rami, may become diseased and cancerous, as seen in one case of this series. In two other cases metastatic extension occurred over the suprapubic area.

Schwarz found metastasis in the brain and dura. In one case in the present series there was associated carcinoma of the third cervical vertebra, diagnosed by roentgenogram. This was considered metastatic. Two months prior to death the patient could not move

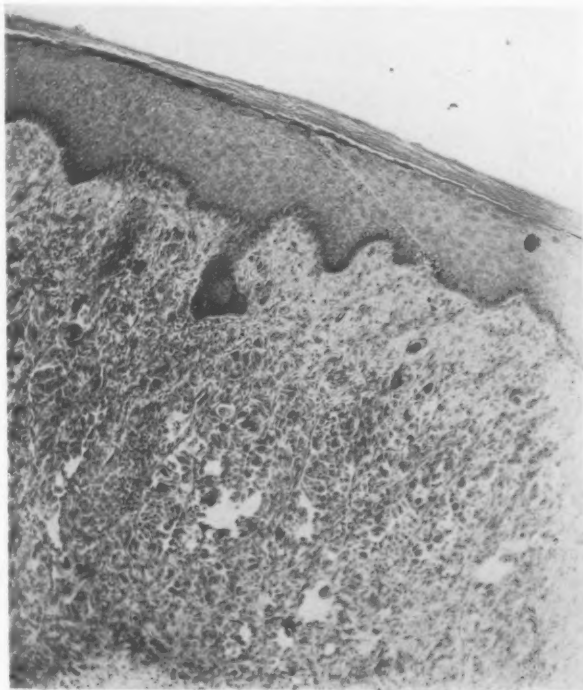


FIG. 20.—Epithelioma, graded 4 (x 75).

his head and he suffered from severe pain. Küstner recorded a case of carcinomatosis of the lung with carcinoma of the heart, liver, spleen, and kidney. Carcinomatous nodules were found by Arnott in the pleura, in both lungs, and in the heart; the primary seat of the neoplasm was the clitoris. Franke, from the clinical symptoms, diagnosed metastasis in the lung in one case. In the present series extensive infiltration of the lung developed in three cases. In another case the patient died two and a half years following local excision of a six-months' growth. According to the daughter of the patient, there were no signs of recurrence, but death had been caused by a relapsing type of pneumonia.

There were three post-operative hospital deaths: one was due to bronchopneumonia and purulent pericarditis; one, to erysipelas and septicaemia; and the third, to extensive cellulitis. Post-mortem examination was made in

two of the cases, but metastasis was not found. In both cases extensive operations with lymphatic dissection had been done, but the nodes were not involved.

The primary growth in all cases was definitely on the vulva. The structures of the vulva which were first involved and the number of cases that represent each type of involvement were as follows: right labium majus, thirty; left labium majus, twenty-seven; right labium minus, one; left labium minus, three; clitoris, four; anterior commissure, two; posterior commissure, one; Bartholin's gland (one right and one left), two; peri-urethral structures,

one. The point of origin is as frequently on the left side as on the right. This is not in agreement with most writers who claim to have found a much higher frequency on the right. Thus Lutzenberger, 1894, in his review of 105 cases, gave the following apportionment: right labium majus in forty-five cases, left labium majus in fourteen, labia minora, in sixteen, clitoris in twenty, commissure in eight, and peri-urethral structures in two.

In the beginning the disease occurs usually as induration of the dermis, a papule, a vesicle, or a nodule. Sometimes there

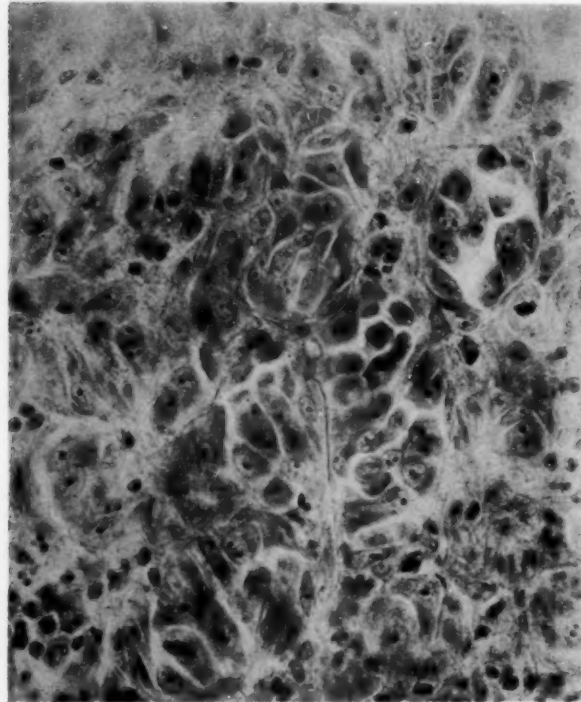


FIG. 11.—Epithelioma, graded 4 (x 350).

appears a crack or fissure. Sometimes the clitoris is enlarged or a Bartholin gland is present. Later, when the disease is further advanced, there are two types: the prominent tumor, and the ulcerating type. Ulceration may be present as early as three weeks after the tumor has been noticed, or there may not be ulceration for a much longer time. After this change has taken place the surface becomes more irregular, raw and granular in appearance. In the crypts collections of pus and debris can be seen. In consistence it is firm, except where there is much necrosis, then soft areas are present. The tumor oozes blood readily on manipulation and is friable. On section it is pearly white, with small yellowish areas of necrosis which can be squeezed out on pressure. At first the tumor is superficial; later, epithelial cords are felt extending into the deeper tissues. The base is hard and indurated.

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In the present series there was tumefaction in only thirty-seven cases, whereas in thirty-four there was ulceration or both tumefaction and ulceration.

Exact dimensions of the lesions were obtained in most cases, but to obtain them in all was not possible, especially if the cautery had been used. In these latter cases only approximate sizes were secured, which were divided, from the surgeons' descriptions, into small, medium and large. The lesions in which exact dimensions were obtained also were divided into three groups. If the greatest diameter of the lesion were two centimetres or less, it was considered small; if it were two to four centimetres, it was considered medium, and if it were more than four centimetres it was considered large. Thus a combination of exact and approximate dimensions of practically all lesions was secured. In twelve cases they were small, in twenty-two, medium, and in thirty-one they were large. In six cases the size was not stated, but in five of these the lymph nodes were found to be involved. From this it may be concluded that the lesions probably were large, or at least of medium size.

Microscopic study was made in every case. The tumors of the Bartholin gland were adenocarcinomas. All of the other growths were squamous-cell epitheliomas. Malignancy was graded on a basis of one to four according to the method of Broders, absolutely independently of the clinical history. The results were as follows: grade one, three cases; grade two, forty-five cases; grade three, seventeen cases; grade four, six cases; total, seventy-one cases. Thus most of the growths were graded two, approaching grade three, rather than grade one.

Treatment.—The type of treatment has been much at variance. Dieffenbach and Hildebrandt first held that new growths were inoperable when the lymph nodes were swollen. Winckel considered excision of the lymph nodes a grave procedure on account of the age of the patient. He believed that excision of the growth was satisfactory. Gartner, in 1905, strongly advised removal of the inguinal nodes even though they were not enlarged, believing that probably they were enlarged and still could not be palpated on account of obesity. He further believed that they could contain malignant cells without being enlarged. Rupprecht recommended extensive dissection of all lymph nodes, superficial and deep, analogous to the operation for carcinoma of the breast. Döderlein, in 1907, thought that if lymph nodes of both sides were cleaned out alike the results would be better. Bruhns, in 1898, showed experimentally on cadavers, by injection of dyes, that involvement of the lymph nodes of the opposite side was readily possible. Basset gave perhaps the first method for dissection of the entire superficial and deep inguinal and femoral lymphatic chains. He advised the two-stage operation, doing the lymphatic excision two weeks before the excision of the tumor. It remained for Kehrer, in 1912, and Stoeckel, in 1910 and 1912, to devise methods for the removal of the pelvic lymph nodes either by extraperitoneal or intraperitoneal procedure.

The present-day treatment of epithelioma of the vulva is surgical, in

the form of wide excision not only of the growth but also of the regional lymph nodes on both sides, whether palpable or not, followed by the use of radium and Röntgen-ray. The latter is considered by Desjardins and Bowing as an aid to operation.

In cases in which the lesion is too far advanced for removal, destruction of the lesion by surgical diathermy, intensive application of radium and superficial and deep Röntgen-ray treatment, is the next best procedure. Surgical diathermy is electrocoagulation and is followed by the use of radium and Röntgen-ray. In the advanced cases radium and Röntgen-ray only are used. The great disadvantage of radium is that its effect diminishes with distance and, therefore, it is reserved for the local lesion and also for enlarged palpable lymph nodes. Röntgen-ray is employed by the superficial and deep methods. The local lesion often responds well to radium and also to the Röntgen-ray; there is much alleviation of pain and inhibition of the external growth for a time, but later the disease resumes its course.

In recurrent cases surgical procedures are again indicated first of all, provided there is anything that can be removed, but it is not the local lesion that causes death. It is the secondary lesion which ends the patient's life and usually the recurrence following an operation is not local, but lymphatic. In these cases radium and Röntgen-ray are employed in increasing doses again with much relief from pain, swelling, œdema, and with decreased amount of discharge.

In the present series the initial treatment in the seventy-one cases was as follows: Knife excision of growth in eleven; knife excision of growth immediately followed by cautery in three; cautery excision of growth in twelve; knife excision of growth and lymph nodes on the same side in eight; cautery excision of growth and knife excision of lymph nodes on the same side in five; knife excision of growth and lymph nodes on both sides in three; knife excision of growth and lymph nodes on both sides followed immediately with cautery in four; cautery excision of growth and knife excision of lymph nodes on both sides in ten; cautery excision of growth and lymph nodes on the same side in one; cautery excision of growth and lymph nodes on both sides in two; surgical diathermy (one labium) in one; surgical diathermy (both labia) in one; palliative vulvectomy in one; and no treatment because of inoperability in nine.

Besides the foregoing treatment nineteen of the patients were treated also with radium and Röntgen-ray post-operatively received. Three received radium and Röntgen-ray treatment pre-operatively as well as post-operatively. Radium alone, post-operatively, was used in eleven; whereas in three, Röntgen-ray alone was used post-operatively. In five of the inoperable cases radium and Röntgen-ray treatment only was given. In the remaining four inoperable cases treatment was not given.

The choice of treatment is governed by the particular case. The grade of epithelioma, the age of the patient, the extent of the lesion, the associated

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lesions, and the patient's general condition all must be taken into consideration. In only three cases palpable lymph nodes were not dissected, in two cases on account of old age and debility, and in the other case on account of advanced myocardial degeneration.

The radical procedure of removing the pelvic lymph nodes seldom has been resorted to and was not followed in any of the cases in this series. It is doubtful if such radical and extensive treatment is altogether justifiable in feeble and decrepit women in the seventies and eighties, and these women represent a large percentage of the patients. Operative encroachment on the urethra, furthermore, is not justifiable.

Results and Prognosis.—Epithelioma of the vulva is not rapidly progressive, but almost always it brings death to its victim.

Rothchild gave the following statistics from 225 cases reviewed by him:

Of the 111 patients operated on without excision of the lymph nodes there were recurrences in seventy-one (63.96 per cent.); after four to five years' observation, nine (8.11 per cent.) still were free from recurrence.

Of the eighty-four patients operated on with dissection of the lymph nodes there were recurrences in fifty-one (60.7 per cent.). After the same observation period as in the other group, eight (9.5 per cent.) still were free from recurrence.

Schultze reviewed cases, including the twenty-three cases of Schwarz, and reported the following: Fourteen patients were free from recurrence after five years' observation; six patients were free from recurrence after four years' observation, and eight patients were free from recurrence after three years' observation.

In the present series, not counting the three patients who died following operation, or the six patients who could not be traced, four of whom had lymphatic involvement at the time of operation, sixty-two patients remain for consideration. Forty-four of these are dead from carcinoma; only one had died from some other cause, namely, relapsing pneumonia two and a half years following operation. It may be that the pulmonary condition was a metastatic lesion.

The average time of life, of the forty-four patients who died from carcinoma, from the time of their first examination at the clinic to the time of death, is two and twelve-hundredths years. This average is derived from the following figures: Two patients lived nine years; one patient, eight years; three patients, six years; one patient, five years; one patient, four years; four patients, three years; seven patients, two years; five patients, one year, and twenty patients, less than one year.

Four patients are living, but have recurrences: one, after eight years; one, after seven years; one, after four years, and one in less than one year.

Thirteen patients are living and are free from recurrence. Their average time of life, from the first examination at the clinic to the present date, is seven and seventy-seven hundredths years. These patients and the time since examination are grouped as follows: Two patients lived fifteen years;

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one patient, twelve years; three patients, nine years; one patient, seven years; one patient, six years; one patient, five years; one patient, three years; two patients, two years, and one patient, one year.

The duration of life from the point of view of operative procedure is as follows:

Group	Cases	Duration of life, years
1 Extirpation of the growth	26	3.25
2 Extirpation of the growth and of the lymph nodes on the same side	14	3.64
3 Extirpation of the growth and of the lymph nodes on both sides	15	5.00

Generally speaking, the cases in Group 1 were not as far advanced as those of Groups 2 and 3. However, of the fourteen cases that were diagnosed as recurrent, six were in the first group, three in the second, and two in the third. The remaining three cases were inoperable.

Fourteen cases in the series of seventy-one were diagnosed as recurrent, and operation had been done elsewhere. In all of these fourteen the operation that had been done elsewhere was simple excision of the growth with the knife or cautery. The tumor had been removed by surgical diathermy in one case.

Of the twenty-six patients who were operated on by extirpation of the growth, three returned later with lymphatic involvement. Seven of the group are still living, six of whom are free from recurrence.

Of the fourteen patients who were operated on by extirpation of the growth and of the lymph nodes on the same side, two returned for further treatment. One of these had lymphatic involvement of the opposite side four months after the first operation. The other returned with local recurrence, as well as with recurrence in the groin on the same side. Three of the group are living and are free from recurrence.

Of the fifteen patients who were operated on by extirpation of the growth as well as by bilateral lymphatic dissection, three returned, one of whom had a local recurrence. The other two had lesions in opposite labium. One of these had been free from recurrence for eight years and the growth for which she returned is probably an independent one; the other patient had been free from recurrence for four years. Four of the group are living and are free from recurrence.

Three of the four patients with epithelioma of the clitoris died after an average duration of life, from the time of their examination, of ninety-seven hundredths of a year. The fourth patient is living and is free from recurrence after nine years. In this patient the growth was small, was of less than six months' duration, the malignancy was graded two, and the operation consisted of wide excision of the growth and bilateral lymphatic dissection. The lymph nodes were not involved.

There were two patients with involvement of one of the Bartholin glands.

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One of them lived eighty-three hundredths of a year. The lesion was of four months' duration, of medium size, the malignancy was graded three, and the operation consisted of wide excision of the tumor. The other patient is living and is free from recurrence after two and seventy-five hundredths years. The growth was of one year's duration, of medium size, the malignancy was graded two, and as in the first instance the operation consisted of excision of the tumor.

The average duration of life of all the patients in relation to the grade of malignancy (tabulation) does not include the six patients who were not traced nor the three who died soon after operation, but it does include the other sixty-two patients of the series of seventy-one and is based on the interval from the time of the first examination at the clinic to the time of death, or, if the patients are still living, to the present time.

Grade of malignancy	Cases	Average duration of life, years
1	3	5.95
2	37	4.37
3	16	1.91
4	6	1.70

All the patients with malignancy graded one are still alive, while those with malignancy graded four are dead. Of the other thirteen patients who are living, ten have malignancy graded two and in three it is graded three.

The grading of the malignancy and the average duration of life of the patients who have died of the disease are as follows:

Grade of malignancy	Cases	Average duration of life, years
2	25	2.79
3	13	1.04
4	6	1.70

SUMMARY AND CONCLUSIONS

1. A series of seventy-one cases of primary epithelioma of the vulva, seen at The Mayo Clinic between 1907 and 1927, is reviewed.
2. Epithelioma of the vulva is a comparatively rare disease. The ratio of this disease to carcinoma of the cervix is 1.25.
3. The lesion is most common in the sixth and seventh decades. The youngest patient in the series was aged twenty-seven years and the eldest eighty-six years.
4. Trauma does not seem to hold any etiologic relationship. On the other hand, causes of chronic irritation, such as pruritus, particularly if it exists before there is any sign of a tumor, must be considered as a significant etiologic factor. Forty per cent. of the patients gave a definite history of preëxisting pruritus.
5. The most common symptom is itching. Ulceration may appear any time during the course of the disease; 47.5 per cent. of patients had ulceration when first examined. This is associated with pain, more or less dis-

charge, and at times with slight bleeding; then follows intractable insomnia, secondary anæmia, cachexia, and not infrequently urinary complaints.

6. Early diagnosis is of primary importance. Women must be taught to abandon the idea of false modesty and physicians must make a careful examination. Patients with pruritus should be particularly instructed regarding the value of repeated examination and of immediately reporting any lesion.

7. In the differential diagnosis metastatic growths, tuberculosis and syphilis must first be eliminated. If there is any doubt a biopsy should be made.

8. The local lesion may be of the superficial vegetative type or it may be of the deep infiltrative type.

9. Metastasis may occur any time during the course of the disease. The lymphatic drainage with the exception of that of the clitoris is first to the inguinal lymph nodes, usually on the same side; but drainage to the opposite side also is anatomically possible and not infrequent. The lymphatic drainage from the clitoris is usually directed into the pelvis; similarly, the inguinal lymph nodes drain directly into the pelvis.

10. The regional lymph nodes may be palpable without containing malignant cells, and conversely the nodes may contain malignant cells without being palpable. The only way to be sure whether or not they contain malignant cells is to remove them and to study them histologically.

11. Epithelioma of the vulva arises most frequently from the labia majora. The disease occurs as frequently on one side of the vulva as on the other.

12. The majority of cases is of an average grade of malignancy, grade two, approaching grade three rather than grade one, according to Broders' classification.

13. Treatment must be fitted to the individual case. Wide excision of the local growth and excision of the superficial and deep inguinal nodes on both sides, whether enlarged or not, supplemented by radium and Röntgen-ray, is the treatment of choice unless metastasis obviously has advanced beyond the point where surgical intervention can help the patient or unless the existing growth has been graded three or four.

In these cases in which the malignancy is of the graver types, three and four, it would seem wiser to excise only the local growth and supplement this by radium and Röntgen-rays applied over the site of the original growth and the lymphatic drainage.

Finally, in those cases in which there is obvious lymphatic involvement and a graver type of malignancy, graded three or four, radium and Röntgen-ray alone should constitute the treatment because in these cases the recurrence is too prompt to warrant surgical procedures.

14. Forty-five patients are dead. All of these except one died from carcinoma. The remaining seventeen patients of the series are still living. Of these, thirteen are free from recurrence after an average duration of seven and seventy-seven hundredths years. One patient had recurrence after eight years, one after four years, and one within less than a year

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after operation. Therefore, the prognosis is fair for prolongation of life, but poor for cure and would seem to be in direct proportion to the grade of malignancy.

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OSTEOMYELITIS OF THE VERTEBRÆ

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(Continued from page 570)

Symptoms.—The general symptoms and the course of acute infective osteomyelitis of the vertebræ differ in no essential particulars from those observed when the same disease attacks the bones of the limbs. The local signs, however, do present special characteristics, and these differ strikingly according to the segment of the spinal column affected.

The general clinical symptomatology of vertebral osteomyelitis may assume several different forms, according to the severity of the infection. Several clinical groups and subgroups can be differentiated because of this factor. These have been previously indicated in other publications and are repeated here for emphasis and especially because osteomyelitis of the vertebræ, more than other forms of acute osteomyelitis, illustrates these clinical subdivisions most clearly and emphatically.

1. The clinical picture of the cases in this group is that of a profound general infection—there is marked toxæmia, and there is a very severe organic reaction. The disease begins with violent chills and high fever follows; the general condition frequently and suddenly becomes very bad; the pulse becomes weak and feeble; the urine is scanty and sometimes contains albumin; diarrhœa often appears; the patient is prostrated, and is covered with perspiration. In the most severe cases death follows in a few hours from the general infection.

A local focus of osteomyelitis is either not demonstrable at all because of the paucity of local signs and symptoms, or because the latter are hidden in the profound intoxication; or if present, the local lesion is easily recognized as being of no consequence in the total clinical picture. The physical basis of the picture lies in an extreme and severe general blood infection with highly virulent organisms, in which the bacteria are rapidly being discharged into and are multiplying in the blood stream and because of which the subject is rapidly being overwhelmed by a tremendous intoxication. The subsequent multiplication in the blood stream depends on other factors, the most important of which lie in the high virulence of the infecting organism and in the poor resistance of the subject. An endocarditis is usually found under these conditions. In this variety the local point of fixation in the bone plays no rôle in the production of any part of the clinical picture. These are the cases in which a diagnosis is frequently impossible. They are often mistaken for typhoid fever, cerebrospinal meningitis or some unknown infection. Usually the inflammatory picture in the bone—the osteomyelitis—is not in a

very advanced stage at the time the lesion is exposed, either on the operating table, or, as more commonly happens, in the autopsy room.

2. In the cases of vertebral osteomyelitis of moderate severity an exact diagnosis can usually be made. As in all cases of osteomyelitis, there are general symptoms such as fever, chills and headache, etc., etc. Two subgroups can be distinguished:

A. In the first variety a focus of osteomyelitis is present with well marked local signs and symptoms but without any clinical signs of a general blood infection. A bacteriæmia is not present. The physical basis for this variety lies (*a*) in a primary and temporary bacteriæmia; (*b*) in the development of a fixation point in a bone; and (*c*) in the subsequent spontaneous disappearance of the bacteriæmia.

B. In the second variety a well-marked focus of osteomyelitis is present with abundant local signs and symptoms and, in addition, there are clinical indications of a bacteriæmia as evidenced by the general signs and symptoms and by the demonstration of living bacteria in the blood stream. The physical basis for this variety is the presence of an infected thrombus-embolus formation which serves to keep up a demonstrable bacteriæmia by constantly feeding into the blood stream a comparatively small number of viable organisms. Most commonly, after efficient surgical treatment, the bacteriæmia eventually disappears and a recovery is made. It must be remembered that any of these cases may at any time pass into the first group. The possibility also exists, as mentioned in preceding publications, of the local focus of osteomyelitis in cases of this variety becoming a secondary point of distribution.

In actual disease it seems certain that the cases differentiated in each of these three groups from progressive stages each from the next preceding group. A mild case may transform itself into a severe case and, conversely, a severe case having been appropriately treated, may retrogress as it proceeds to healing and recovery. These interchanges are constantly occurring in clinical surgery. Usually when a mild case assumes clinical and laboratory characteristics of a severe case there is a continued progression until the eventual fatality. In actual practice cases in Group I must necessarily first pass through the stages indicated by Group II; the time interval may be so short, however, owing to the virulence of the infecting organism, as to be unrecognizable. One can explain the cases that apparently begin with the characteristics of the cases in Group I in this way. In many cases characteristics can be distinguished which belong to both Group I and Group II; and insofar as any case partakes of characteristics not belonging to its group, it differs in its clinical manifestations.

In actual practice the illness commences suddenly, sometimes spontaneously, at other times after an injury often slight in nature. There is malaise, local undefined or no pain, fever often accompanied by an initial rigor, and when the patient comes under observation he presents the aspect of extreme illness usually observed in an acute infection of bone. The grade of these symptoms corresponds to one or other of the groups previously made. At

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an early stage a tendency to assume the supine posture is to be noted, also tenderness and rigidity of the affected portion of the spine. In a few days, especially in the cases corresponding to those in Group II, local signs commence to point to the actual seat of disease.

When the lesion is in the neural arch or in any of its processes, the signs consist in the development of an indefinitely demarcated and widespread œdematous swelling and tenderness over the appropriate part of the spine. This swelling is rarely detected before the third or fourth day, and in many of the recorded cases not before the eighth or tenth. The swelling may start centrally and spread in each direction when the spinous process or the neural arch in its immediate neighborhood is the part primarily affected, or it may be unilateral when the transverse process or lateral portion of the arch are attacked, often spreading widely over the ribs. The most striking characteristic of this group of signs is the widespread area of the soft parts affected compared with the extent of the bone disease. In a considerable number of the cases great distention of the superficial veins over the surface of the abscess has been described.

In the less severely toxic cases pain is a very important symptom. The pain is of two forms, spontaneous or provoked. The characteristics of the spontaneous pains are rather vague. The patient complains of a diffuse spinal pain which may become manifest several days or even weeks before the appearance of the infectious symptoms. In addition to the spontaneous pain there are always other painful sensations. Any movement of the spinal column increases the pain and the patients assume very strange attitudes in bed. There is also regional rigidity, which is probably due to contractures of the muscles. This is especially characteristic of osteomyelitis involving the cervical spine.

Provoked pain has a very great diagnostic value and permits localization of the process at a relatively early stage of the disease. Pressure over the affected region produces very severe pain.

In a short time the signs and symptoms of an abscess appear. Locally these can be classified into three groups:

I. Lesions developing on the posterior aspects of the vertebræ. Suppuration occurs along one or other of the spinal gutters on the posterior aspects of the neck or the torso. The symptoms are sharply demarcated and distinct and are those of a deep-seated abscess in the musculature of the back; the diagnosis is not made difficult by extraneous and associated factors. The swelling, at first purely œdematous, becomes indurated centrifugally, and softens in its centre where it overlies the affected bone. This stage may not be reached until the tenth day, and in many of the recorded cases the abscess was not observed until a much later date. When the abscess is opened denuded bone is generally detected at the bottom.

II. Lesions developing on the anterior aspects of the vertebræ—bodies, pedicles or transverse processes. The local symptomatology is much less clear. When the body of the vertebræ is affected the difficulties of diagnosis may

be immensely increased, because the abscess is situated so much more deeply. In the early stages, therefore, the tendency to maintain the supine posture, rigidity of the spine, and pain on movement, taken together with the general condition of the patient, in the absence of any indication of visceral disease or nerve complications, may be the only signs to depend upon. The various localizations of the accumulations of pus and the various paths along which these develop extend or migrate have been indicated previously (*vide supra et infra*). Because of these circumstances factors become introduced which are competent to hide the nature of the original disease and make difficult the essential diagnosis.

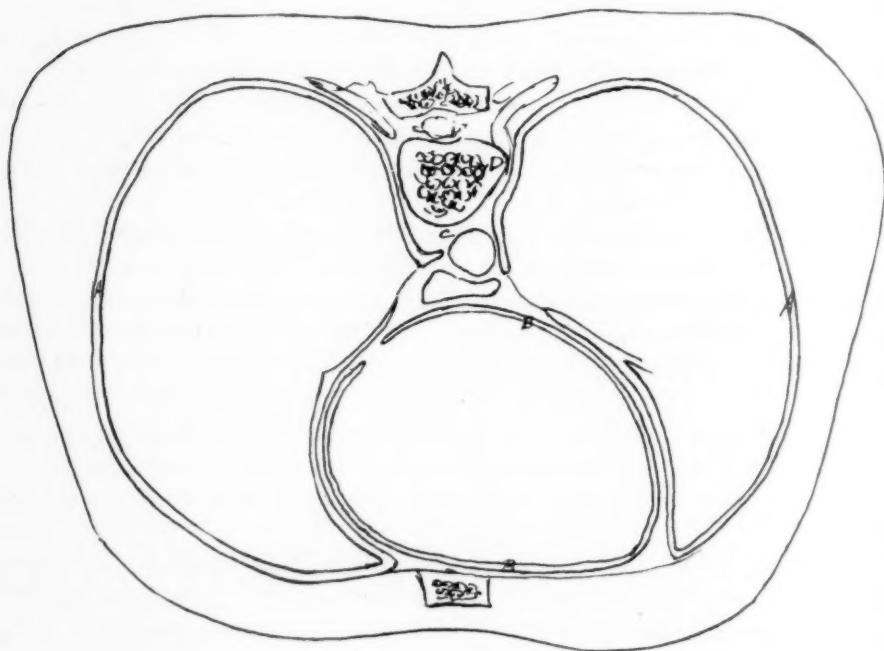


FIG. 4.—Transverse section of the thorax taken from the *Army and Navy Manual of Surgery*. To show the anatomical relationships of the pleurae A, the pericardium B, the mediastinum C, and the anterior aspects of the bodies of the vertebrae D, and their pedicles and laminae; and the ease with which suppuration developing in front of the vertebrae can extend or break into any of these spaces.

III. Lesions develop in the depths of the vertebral arches and point into the spinal canal. Secondary effects upon the contents of the spinal canal—spinal cord and coverings—appear early. The local symptomatology also appears early and is sharply demarcated. It assumes the characteristics of inflammatory, or neoplastic disease of the cord and its meninges, or of myelitic changes in the cord substance produced by extraneous compression or by intrinsic degeneration of nerve cells and fibres. The phenomena of the bone inflammation are lost in the maze of neurological evidence.

COMPLICATIONS.—The factors summarized in groups II and III (immediately preceding) give rise to (1) a whole group of complications of osteomyelitis of the spinal vertebrae which are formed by the local extension of the

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original vertebral lesion, as opposed to (2) another group of complications which result from the metastatic distribution of viable bacteria during the course of the primary general infection (bacteriæmia, general sepsis, pyæmia, etc.), to which the vertebral osteomyelitis was secondary. More in detail these complications are as follows:

1. Complications due to the local extension of the disease.

a. Abscess of the Neck.—These abscesses point in the posterior triangles of the neck. The one important symptom which calls attention to the bone origin of the abscess is rigidity of the neck and pain on the slightest movement or jarring of the head; this symptom should lead to the correct diagnosis even in the early stages in which röntgenographic evidence is not available. An illustrative case is the following:

CASE I.—A young boy of fourteen years complained of fever and malaise and at the end of the first week developed an abscess which pointed and was opened and drained behind the sterno-mastoid muscle. Several days later it was noted that a great deal of pain was associated with the dressings of the wound and that it was due to the movements and jarring of the head unavoidable during the manipulations attending the dressing. The diagnosis of osteomyelitis of the cervical vertebræ was made and confirmed by röntgenographic and other evidence. The boy did not do well; he later developed high fever and chills and eventually died from the effects of the suppuration.

b. Retropharyngeal Abscesses.—These nearly always occur in children and the diagnosis of the original bone disease can only be made by the X-ray or because of the ability to feel diseased bone in the depths of the abscess. The etiology of many of these retropharyngeal abscesses is undoubtedly lost in the further development of the lesion. An illustrative case is reported by Makins and Abbott:

CASE II.—The patient was sixteen years old. There was stiffness of the neck with pains between the shoulders and in the temporal regions. There was swelling of the neck after two or three days. On the ninth day the patient had fever and the neck became rigid. There was no fluctuation but there was marked tenderness at the level of the axis. An incision was made on the tenth day in the median line of the neck but no pus was found. On the twelfth day the tenderness extended to the middle part of the dorsal spine. On the thirteenth day there were pains in the ankles, elbows and shoulders. The patient had delirium and generalized hyperæsthesia and died the next morning. An examination post-mortem showed that the axis was denuded and rough; the periosteum of the atlas was softened. There was a retropharyngeal abscess at the level of the four first cervical vertebræ.

c. Extrapleural (Retropoleural) Abscess. d. Mediastinal Abscesses.—These occur most commonly in association with osteomyelitis of the bodies of the dorsal vertebræ. A correct diagnosis is made with difficulty. Dysphagia from pressure upon the œsophagus, the appearances of pleural or pulmonary symptoms from direct extension of the inflammation and possible signs of pressure upon other structures such as the large intra-thoracic veins or important nerves, are the main elements that cause one to suspect such cases. Makins and Abbott report two cases. E. Schwartz and L. C. Wagner each report a case in which the diagnosis was made by X-ray evidence. An illustrative case is the following:

CASE III.—The patient was fourteen years old. There were pains in the back and left leg and the latter became red and œdematous. The general condition was very bad on the ninth day and abscesses were found on the anterior part of the left tibia and at the distal articulation of the great toe. These abscesses were incised. An abscess at the back of the foot was opened on the eleventh day. There were pains in the back on the fifteenth day and the patient died on the morning of the twentieth day.

The post-mortem examination showed that the left sides of the bodies of the second, third, fourth, fifth, and sixth dorsal vertebræ were bare and eroded, and in connection with them was an abscess containing about one ounce of pus situated behind the left

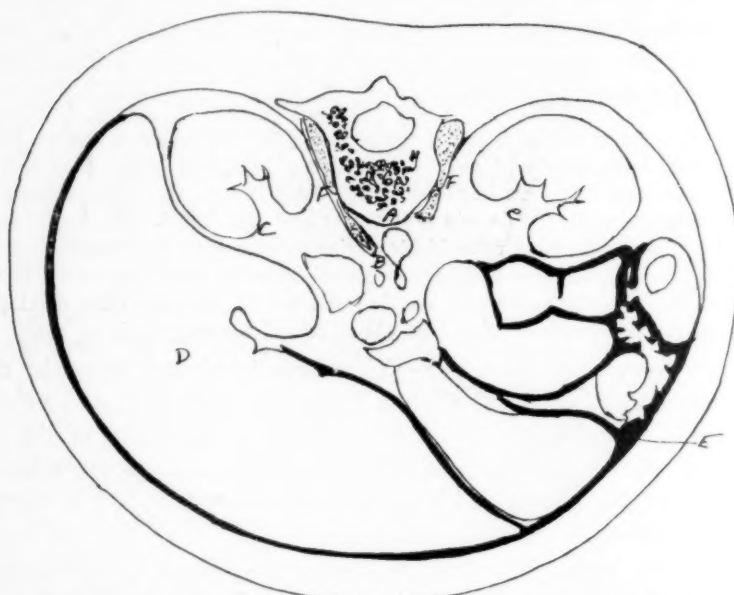


FIG. 5.—Transverse section of the abdomen through the liver and kidneys. Taken from the *Army and Navy Manual of Surgery*. Showing the relationships of the vertebræ on their anterior aspects A, the retroperitoneal space B, the kidney pouches C, the various aspects of the liver D, the peritoneal space E, and the underside of the diaphragm F, and the ease with which suppuration spreads into any of these directions.

pleura. There was great distention of the œsophagus and stomach, and the latter contained nearly three pints of foul-smelling fluid. The condition of the legs was as described above, and no secondary deposits were found in the viscera. The brain and cord were not examined.

c. Pleurisy With and Without Effusion. f. Empyema Thoracis.—These complications are usually associated with neighboring accumulations of pus resulting from disease of the dorsal segments. Mediastinal and retropleural forms of abscess most commonly antedate these pleural complications, and the mechanism is most commonly that of a free perforation. Clear effusions do not always antedate the empyema. The diagnosis of the pleural complication is always easily made. The diagnosis of the vertebral osteomyelitis has been made frequently but in some of the cases it escaped notice until the post-mortem examination. The cases terminate fatally very commonly owing to the general infection (bacteriæmia) or to other general or local causes, especially extensions of the suppuration into other important cavities or

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viscera. Almost all of the men who have made contributions to the subject of osteomyelitis of the spine have seen or reported cases. Illustrative cases are the following:

CASE IV.—A forty-six-year-old man developed malaise, high fever and sharp pain along the dorso-lumbar spine and over the left chest posteriorly. The pain was aggravated on deep breathing. Five days after the onset he was admitted to the hospital with a temperature of 104.6° F.

The physical examination showed rigidity of the neck, voluntary restriction of motion in the spine, definite lung signs in the left axilla, with signs of fluid, a negative Widal, a negative blood culture and meningeal signs. Aspiration of the left chest gave 15 c.c. of clear yellow fluid which contained 95 per cent. of polymuclear cells and staphylococcus aureus. The meningeal signs continued and the patient finally ceased about ten days after admission to the hospital.

Post-mortem Examination.—The left pleural cavity contained about 800 c.c. of a turbid reddish-yellow fluid, apparently purulent. This had displaced the heart to the right and had compressed the lung to about one-fourth of its original volume. The visceral layer of the pleura was covered with a shaggy fibrinopurulent material. In the left costovertebral angle was a large abscess cavity, larger than a fist, which was situated between the parietal pleura and the thoracic wall, and occupied the area reaching from the level of the eighth to the level of the twelfth dorsal vertebra. This communicated by a pin-point perforation with the left pleural cavity. The contents of the abscess cavity consisted of a very thick mucoid yellowish pus. The periosteum seemed to be lifted off from the left side of the body of the ninth dorsal vertebra, from its transverse process, and from the adjacent portion of the ninth rib. These areas felt roughened.

The spinal canal contained a large collection of stringy yellowish pus infiltrating between the dura and vertebral column from the level of the eighth dorsal vertebra down to the level of the first lumbar. The purulent process communicated through the eighth left vertebral foramen with the abscess cavity previously described in the left costovertebral angle. The left half of the spinal surface of the ninth dorsal vertebra is denuded of periosteum and markedly eroded. The purulent process had apparently started within it. Upon opening the dura there was found to be no increase in the cerebrospinal fluid and no visible pathological lesion upon the pia or within the cord.

CASE V.—Morian reported the following case: The patient was seventeen years old. He had pains in the various joints, the head and back on January 6 and was obliged to go to bed. It was believed that he had pneumonia. He had high fever and stiffness of the neck and shoulders with tenderness of the spinal processes of the last dorsal vertebrae on January 11. During the following days fluctuation appeared at the level of the eleventh and twelfth dorsal vertebrae on each side of the median line. An incision was made on the twenty-third on the left side, and after it was found that there was denudation of the arch of the twelfth vertebra a grooved director was inserted into the abscess on the right side and a counter opening was made at that point. An iodoform dressing was applied. The patient improved for a short time but died on the twenty-eighth of cardio-pulmonary complications.

The autopsy showed that the bone was filled with pus. There was fluid in both pleural cavities and the lungs were very congested. Both pleurae communicated with the vertebral abscess. The arch of the twelfth dorsal, its spinous process and the left lateral part of the vertebrae were denuded. There were several small suppurating foci in the bone. The spinal meninges were suppurating and there was injection and oedema of the pia mater. There were infarcts in the liver and the spleen.

g. Pericarditis; Various Forms Including Suppurative Types.—These lesions are found most commonly in association with pleural involvement.

Occurring by direct extension of the original focus of infection in the vertebræ these pericardial complications are extremely rare, but when they occur as metastatic foci resulting directly from the original general infection (bacteriæmia) to which the spinal lesion is also metastatic, they are quite commonly found at post-mortem examination. Makins and Abbott and Ashhurst and Wadsworth each report a case.

h. Iliopsoas Abscess. i. Intra-abdominal Abscesses.—These result from lesions in the anterior aspects of the lumbar vertebræ. The abscess forms rapidly and gives rise to the ordinary signs of local pain, tenderness, flex-

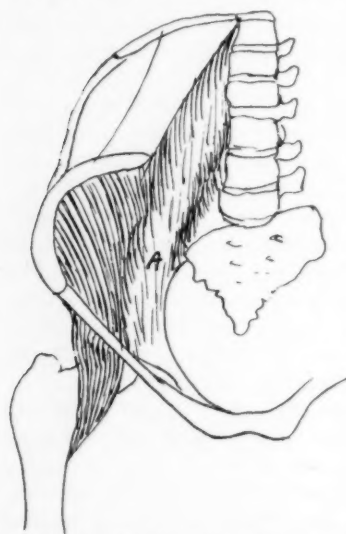


FIG. 6.—To show the iliopsoas muscle A. To show the path in the development of a psoas abscess from suppuration derived from any of the appropriate vertebræ.

ion of the thighs and pain on movement of the hip-joints. Owing to the acuteness of onset, a group of symptoms, namely, distention of the abdomen accompanied by pain and tenderness, assume a dominating prominence and commonly throw the others in the background. The diagnosis is difficult and the essential nature of the disease has been mistaken for typhoid fever, appendicitis, peritonitis, etc. The differentiation should, however, be easily made from the local signs and symptoms referable to the spine, namely, rigidity, tendency to maintain the supine position, and the signs of a local inflammatory focus in the back overlying the spine. In differentiating between enteric fever and osteomyelitis, it should be remembered that an enlarged spleen also occurs with ordinary general infections (bacteriæmia, pyæmia, etc.)

Illustrative cases are the following:

CASE VI.—Three weeks before admission the patient developed a furuncle of the left buttock. The resulting abscess was incised. A few hours later she began to have pain in the left side and in the back so that she could barely move. Then she developed fever. The physical examination showed that the wound in the buttock was healed. There was no tenderness over the spine. In the lungs there was dulness and diminished breathing at both bases. The blood contained 160 colonies of staphylococcus aureus cubic centimeter.

About one week later a mass was felt in the left lower quadrant of the abdomen, extending from Poupart's ligament to about the level of the umbilicus; the mass was very tender. The mass grew larger and more tender. At operation the peritoneum overlying the lumbar vertebræ was found to be thickened and œdematous. A large abscess was present in the depths of the psoas muscle. Later definite röntgenographic evidence of bone destruction was found. The patient was discharged from the hospital with an open sinus.

CASE VII.—The patient was in perfect health until three months ago when she suddenly noticed pain on the inner aspect of the right knee, radiating up into the right groin, which persisted. The pain was aggravated by motion or in damp weather. At the same time that the pains began she noticed large lymph nodes in her right groin which

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were tender and increased in size. A mass the size of an orange could be felt in the right lower quadrant of the abdomen. Extension of right knee caused pain referred to upward to the groin with spasm. A kyphoscoliosis of the spine with sharp angulation laterally was present. Tender inguinal nodes were palpable. An adenoma of thyroid was present. The patient was in the hospital for eight days. For five days prior to death she ran temperatures between 100° and 104° . An X-ray study of the lower dorsal and upper lumbar spine showed a marked degree of spondylitis with bridging between the transverse processes of the second, third, and fourth lumbar vertebræ on the left side.

The post-mortem examination showed a large retroperitoneal abscess along the course of the psoas muscle. More than a litre of greenish pus was present and the psoas muscle was completely destroyed. The posterior wall of the abscess was formed by dense scar tissue which extended upward to the eleventh rib. After removal of this tissue which firmly adhered to the spine, the bodies of the third and fourth lumbar vertebræ were found to be eroded. The third vertebra contained a rather old abscess lined by a membrane of granulation tissue near the posterior surface. There were several smaller abscesses within the spongy bone of the fourth vertebra from which pus could easily be expressed.

CASE VIII. (Makins and Abbott.) A man of forty-six years developed pains in the back which gradually increased in severity. A large superficial abscess appeared in the right buttock on the twenty-first day. This abscess was opened on the twenty-sixth day. He had profuse diarrhoea. He died suddenly on the twenty-seventh day. The post-mortem examination showed that the superficial abscess which was opened communicated with a large abscess of the iliac fossa. The transverse process of the fourth lumbar vertebra was denuded and necrotic. The appendix was adherent to the anterior wall of the abscess. The bone marrow and the rest of the spine were normal.

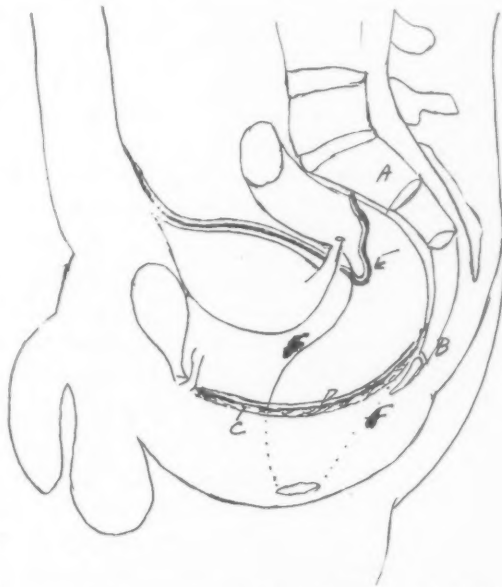


FIG. 7.—Antero-posterior vertical section of the pelvis taken from the *Army and Navy Manual of Surgery*. To show the relationships of the sacrum A and coccyx B, and the levator and muscle C, and anal fascia D, the reflection of the peritoneum E, and the perirectal and peri-anal F. Compare with the text for the various forms of the localization of any suppurating focus derived from the coccyx or sacrum.

j. *Various Forms of Pelvic Abscess, Ischiorectal, Para-anal, and Gluteal Abscesses.*—Many of the obscure and undiagnosed cases belong in this group. The diagnosis has often been made only at the post-mortem examination. However, in many cases the diagnosis of pelvic abscess was easily made but the essential pathology was not recognized or was only recognized accidentally. Makins and Abbott have seen extension of the suppuration to the sacroiliac-joints; and in one case a lumbo-sacral abscess formed concurrently with one in the pelvis. Makins reports the following very unusual case:

CASE IX.—The present illness commenced fifteen months before admission with the development of two small hemorrhoids. Later a discharge of pus and blood appeared

and continued from the rectum. Antiluetic treatment was of no avail. Then a peri-anal ulcer formed. A palliative colostomy was later done which terminated fatally eight days later. The post-mortem examination showed osteomyelitis of the fifth lumbar and first sacral vertebrae, bilateral pelvic abscess, perforation into the rectum, ulcerative proctitis, peri-anal ulcer, thrombo-phlebitis of the left common iliac vein. The entire process had evidently begun in the vertebra.

CASE X.—A peri-anal abscess recurred eight months after the original abscess had healed. Multiple fistulae were present. During the revision necrotic bone was demonstrated in the sacrum and coccyx and a large abscess was present in the pelvic retroperitoneal space. The patient ceased. Permission for an autopsy was not obtained.

Daverne reports the following rather typical case:

CASE XI.—The patient was a child six years old who was admitted to the hospital for severe general symptoms characterized by a rapid pulse, high fever and the local signs of an endocarditis. There was nothing to indicate the existence of a purulent focus until a swelling appeared in the buttocks. On incision two abscesses were opened, one superficial and the other deep. There was denudation of the anterior surface of the sacrum and also of the bodies of the lumbar vertebrae, especially on the right side. The pus gave pure cultures of a staphylococcus. Improvement was extremely rapid. The child was able to leave the hospital two months after the operation completely cured.

k. Various Forms of Disease of the Contents of the Spinal Canal.—Complications due to involvement of the cord and its coverings either by pressure, by actual extension of the inflammatory focus or by both are frequently the cause of the symptoms which attract notice. The usual premonitory symptoms of interference with nerve function may pass unnoticed in consequence of the serious condition of the patient; or may possibly be ascribed to toxæmia. Later both sensory and motor disturbances occur. These include shooting pains in the limbs; hyperæsthesias of various kinds and extents, anæsthesias over definite areas corresponding to definite nerve centre or nerve trunk distributions, twitchings, tremors, convulsions, and paralyses of various kinds involving one or more muscle groups, limbs, the trunk, the rectum or the bladder. When the primary disease is in the neighborhood of the cervico-dorsal junction, pupillary disturbances may be elicited. Distention of the abdomen is another symptom which may point to secondary involvement of the intra-abdominal ganglia. The pathological forms under which the clinical symptom complexes appear include: (1) pachymeningitis externa; (2) intraspinal extradural abscess; (3) arachnoiditis and forms of serious effusion in the cord membranes; (4) spinal and cerebrospinal forms of purulent meningitis; (5) myelitis; (6) individual or muscle group paralyses including paraplegia. The following are illustrative cases:

CASE XII.—(Daverne.) The patient was a boy sixteen years old who had fallen on his back. He had rather sharp pains but was able to continue walking and working for four days. Then he developed chills and fever. The severe pains in his back continued. At the hospital a diagnosis of typhoid fever was made because of the signs of general infection and prostration. However, considerable oedema of the lumbar region with marked pain on pressure was noted. There were no signs of spinal meningitis. On incision, a rather large abscess was found within the sheaths of the deep muscles. The laminae and the spinous process of the third lumbar vertebra were denuded. The wound

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was drained. The patient died during the night. The pus contained a large number of staphylococci.

The autopsy showed: a beginning bronchopneumonia; an osteomyelitis confined to the laminae and the spinal process of the third lumbar vertebra; and an *extradural abscess*. The cerebral spinal fluid was normal.

CASE XIII.—(Daverne.) A boy six years old who had always been in good health suddenly had high fever and severe thoracic pains. Three days later he had a paralysis of all the territory below the third thoracic vertebra. A diagnosis was made of *compression of the cord* by pus or blood. A long incision was made and the spine was trephined. Much pus escaped from the spinal canal but the dura mater was intact. The child died. No autopsy was made.

CASE XIV.—(Daverne.) The patient was a man thirty-four years old. Within a week's time he developed high fever, a very bad general condition, pains in his knees, delirium and slight deafness, difficult respiration, unconsciousness, convulsions, and coma. There was no paralysis. The patient died.

The autopsy showed a *serous effusion of the arachnoid*. There was a double psoas abscess, more extensive on the left side. There was an osteomyelitis of the body of the first lumbar vertebra. The inter-vertebral disc between the first and second lumbar vertebrae was completely destroyed and the abscess communicated with the peridural space.

CASE XV.—(Lucas.) The patient was a man twenty-one years old who complained of pains in the back, loss of appetite and constipation. He became progressively worse, became delirious, and finally completely unconscious. There was stiffness of the neck and rigidity of the spinal column. The diagnosis made during life was typhoid fever.

The autopsy showed *peri-meningitis and suppurative meningitis* at the base of the cranium, sero-purulent pleurisy, infarcts of the lung, kidneys, prostate and liver, severe pulmonary emphysema and oedema, and large psoas abscesses due to lesions of the third, fourth and fifth lumbar vertebrae.

CASE XVI.—(Lucas.) The patient was a child nine years old who had headache and stiffness of the neck. The general condition became very bad on the fourteenth day and there was a high remittent fever. An abscess of the neck was opened on the twenty-first day. There was a swelling over the right great trochanter on the twenty-fourth day. He became delirious on the twenty-eighth day and died that evening.

The autopsy showed that the posterior arch of the atlas was necrotic and was separated into two fragments. There was a perforation of the dura mater and the intradural space contained a large amount of cloudy fluid. There was *basal meningitis* and *pus in the anterior horn of the lateral ventricles*. There were secondary abscesses in the lungs.

CASE XVII.—(Makins and Abbott.) The patient was a child ten years old who had pains and then swelling of the back. On the tenth day there was a large abscess at the level of the lumbar vertebrae which had retained their normal mobility. The abscess was incised and it was found that the third lumbar spinal process was denuded. His pulse became very weak on the eleventh day and respiration was rapid and superficial. There was oedema over the left great trochanter. He lost consciousness on the thirteenth day. Both sides of the body then became rigid. He died on this day.

At the post-mortem examination the laminae of the third lumbar vertebra were found to be necrotic and there was separation of the spinous process. All the regional muscles were infiltrated with pus and the pus extended also into the spinal canal. The spinal arachnoid was congested. The parieto-occipital part of the left lobe of the brain was softened. There were infarcts and abscesses of the viscera.

CASE XVIII.—An infant developed fever and the mother noticed that the child did not move the left arm. There was an area of induration in the posterior part of the neck. Later the paralysis involved the other arm. The paralysis was of the flaccid type and the reflexes were lost. The lower extremities were somewhat spastic. Anæsthesia of the upper

extremities was defined. An incision was made in the neck and an abscess was drained; denuded bone was palpated in the spinal vertebrae. There was a complete recovery.

CASE XIX.—The patient was a girl twelve years old. She received an injury to her back. Six months later she complained of chills and pains in the legs and back. She had paraplegia on the fourteenth day of the illness. The paralysis was more severe on the left side at first and then complete as far as the thorax. There was a little œdema at the level of the cervico-dorsal region of the spine. The spinous processes of many vertebrae were tender on pressure. She had retention of urine. A diagnosis was made of an ascending myelitis.

The paralysis remained stationary for about one month, the retention changed to incontinence and the temperature decreased. Then it rose again about one month later, and a large abscess was found to the left of the first three dorsal spines. This was incised and it was found that the left lamina of the second dorsal vertebra was completely necrotic as well as the greater part of the spinous process. The right lamina was deprived of its periosteum but was not necrotic. This was also removed, as well as the left transverse process which was infiltrated with pus. A large amount of pus had extended into the spinal canal and the dura mater was covered with a membranous exudate. The wound was drained. No signs of tuberculosis were found.

After a period of improvement during which the anaesthesia descended about three inches, symptoms of cystitis appeared. The patient died three weeks after the operation. No autopsy was performed.

2. Complications resulting from the general infection.—The complications resulting from the general infection form a very important group and consist of metastatic foci of infection resulting from the general distribution of bacteria within and throughout the body via the vascular circulation during the course of the bacteraemia (sepsis, general infection, etc.) from which the vertebral lesion itself resulted. In those cases in which the vertebral focus of infection itself becomes a secondary point of distribution similar lesions result in an exactly like manner during the period in which the secondary bacteraemia is present. These metastatic foci can be arranged in the following general groups:

a. General toxæmia. b. Osteomyelitis in other bones. c. Suppurative and non-suppurative forms of infection in the various joints. d. Infection of the hollow spaces: (A) empyema; (B) pericarditis; (C) peritonitis; (D) cerebro-spinal meningitis; etc. e. Endocarditis. f. Minor abscesses in the fascial planes, etc. g. Lung abscesses. h. Renal infarcts.

Discussion of these groups will be omitted from this communication as beyond the scope of this paper.

Mortality.—The mortality of vertebral osteomyelitis is very large. The general mortality according to Donati is 53 per cent. If the infection extends to the meninges, the mortality rises to 64 per cent. according to Schwartz; and to 71 per cent. according to Makins and Abbott. The mortality for lesions in the arch is 33 per cent. as opposed to a mortality of 78 per cent. for lesions in the body (Donati). Lumbar involvement carries a mortality of 65 per cent., dorsal involvement of 27 per cent., and cervical involvement of 44 per cent. (Donati). Before 1890 the published general mortality reached 81 per cent.; between 1890 and 1900 the mortality was 48 per cent.; and between 1900 and 1905 Donati estimated the mortality to be 22 per cent. This, of course, showed

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a continued improvement. Since 1905 the mortality can be estimated to range in the neighborhood of 35 to 45 per cent., depending on the kind and character of the complicating factors. In the nine cases reported in this communication the mortality was 44 per cent.

Prognosis.—As far as the material to hand goes, it seems that on the whole affection of the posterior neural arch is a more favorable condition than that of the body, although nerve complications are more frequent. This seems to be so because in this situation the disease is more likely to be recognized at an early stage. Then operative intervention will be most effective, as sufficiently early incision may arrest further mischief. With regard to disease of the bodies, only increased experience can show whether a more exact knowledge of the affection will allow the complicated abscesses to be earlier detected and treated; local disease is within the bounds of surgical therapy. Cases of posterior mediastinal abscess from the difficulty of localization are naturally less hopeful. In any case in which mediastinal abscess is suspected, and this naturally applies especially in cases of involvement of the thoracic spine, repeated X-ray examination should be practiced as early as possible in order to detect these localizations as speedily as possible.

Treatment.—The general principles governing the treatment of acute osteomyelitis in general have been described on several previous occasions and they will not be repeated here except in summary: Suffice to say that the cases group themselves into (a) the highly fulminant cases in which the general infection is of such a virulent nature as to make futile any attempt on our part to control the disease; (b) less fulminant infections, but very sick patients with large numbers of viable organisms being discharged into and circulating in the blood stream in whom a radical attack on the local bone lesion is made for purposes of controlling the bacteriæmia; (c) the ordinary cases with bacteriæmias of small or moderate extent, or with sterile cultures in which treatment resolves itself down to the ways and means which will lead to the greatest conservation of form and function and to the best general advantage of the individual patient.

These groupings seem almost best exemplified in the cases of acute osteomyelitis of the spine. The literature leads one to believe that in previous times the principles of treatment previously described by me have hitherto been employed by surgeons on empiric grounds in the absence of any of the newer knowledge. This state of affairs continues to exist to-day even though knowledge of bacterial infection in all of its manifestations—thrombophlebitic lesions, bacteriæmia, etc.—has been increased to a very large extent and the importance of this factor is especially understood in acute osteomyelitis in general. In osteomyelitis of the vertebræ the general use of conservative measures is forced upon the surgeon; radical measures of any kind are not possible because of anatomical and mechanical reasons; and the available therapeutics resolves itself down to (a) the treatment of the local lesion in the bone; and (b) to the relief of the neurological complications of the local lesion. Measures directed to the relief of the general infections are of little

practical importance in cases of sepsis associated with osteomyelitis of the spine and play little, if any, rôle in the progression or subsidence of the associated general infection.

The treatment of the bone lesion itself is necessarily confined to the treatment (proper incision and adequate drainage) of those accumulations of pus previously described in this communication whenever these can be located and reached surgically. These are of three kinds (*a*) abscesses on the posterior aspect of the spine; (*b*) abscesses on the anterior aspect of the spine; and (*c*) accumulations of inflammatory tissue or of pus within the spinal canal.

A. Abscesses on the posterior aspect of the spine are usually rather simple affairs and their proper incision and drainage require nothing more than the simplest of procedures. Subsidence of the tremendous reaction which is frequently present follows quickly after which, when no untoward complications arise or when no sequestration has occurred to delay the healing of the wound, cicatrization proceeds in the normal way. The pus accumulations are commonly at a considerable distance from the skin surface.

B. Abscesses on the anterior aspect of the spine are much more difficult to handle. In those complications in which the abscesses accumulate in the hollow cavities or in obscure and difficult positions, the necessary drainage can be a procedure of much difficulty and of considerable magnitude. Such for instance are the mediastinal and high pelvic abscesses, or the deep-seated subdiaphragmatic abscesses. In a general way the abscesses can be grouped for operative purposes and for securing adequate drainage as follows:

1. Abscesses of the neck. These are of two kinds: (*a*) Retropharyngeal abscesses can be reached in the usual way through the mouth. If the abscesses show any tendency to fill up again, it is much more advisable to abandon the oral route and to drain the abscess frankly from the outside of the neck. Usually this is much more safely accomplished by making the incision posteriorly to the sternocleidomastoid muscle; the latter, when retracted forwards, carries with it the vessels and other important structures and brings one down directly onto the para—and posterior pharyngeal space; this gives a safe channel through which the abscess can be reached and drained. Frequently one or several glands which are enlarged and lie in the drainage path must be removed before the abscess is actually opened.

(*b*) Ordinary forms of abscesses of the neck. Owing to the anatomical arrangements, these either lie in the anterior triangle of the neck or, more commonly, in the posterior triangle. In either case it is the better part of wisdom to allow the abscess to come to the surface (poulticing); incision and drainage of the abscess is then a simple matter.

2. Intrathoracic accumulations. Localized mediastinal, retropleural and all varieties of intrapleural abscesses (empyema) have a much better prognosis than the diffuse form of mediastinitis. Favorably placed mediastinal and retropleural abscesses can be classed with localized empyemas and should be incised and drained according to the best principles in use for drainage of empyemas in general. Unfavorably placed mediastinal abscesses or the

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diffuse forms of mediastinitis are not so simple and procedures of greater magnitude are necessary for their proper drainage. The best approach is by posterior mediastinotomy with the resection of adequate lengths of a sufficient number of ribs at their angles and posterior extremities to furnish a wide approach to the mediastinum. The procedure is relatively difficult and suffers from the danger which all operations of this kind entail—namely, that the suppurative process is caused to spread rapidly in the loose cellular tissues of the mediastinum, where it rapidly escapes beyond surgical control and usually terminates fatally.

Suppurative forms of pericarditis are usually extensions of previously existing accumulations of pus or they are metastatic lesions. In either case they must needs be drained in the usual way by pericardiectomy.

3. Intra-abdominal abscesses. General surgical principles are employed in the incision and drainage of these abscesses. A few of these can be reached by the extraperitoneal route; others must be reached trans- and intraperitoneally. Some, which are operated upon late, point in the usual position of a psoas abscess; these are easily drained extraperitoneally. Others are deep in the abdomen and close to the spine and sometimes high up in the abdominal cavity; these are reached with greater difficulty.

4. Pelvic abscesses. These can be grouped as (a) high pelvic; (b) ischio-rectal; and (c) para-anal abscesses. The latter are the simplest. Ischio-rectal abscesses should be allowed to come down as far as possible when their proper incision is much simplified. High pelvic abscesses are most difficult. In a certain number resection of the coccyx and possibly of the lowermost part of the sacrum is necessary in order to secure adequate drainage. The difficult ones are those which pass out of the pelvic cavity and point in a superficial location as, for instance, some of the gluteal abscesses. The rule is to suspect an intrapelvic origin for any gluteal abscess in which there is marked retention of pus and which shows any tendency to have a much protracted healing stage.

As a general rule no attempt to remove bone tissue should be made in any of these groups of cases when opening and draining any of these abscesses. This rule should not be broken because of the following reasons:

1. Sequestration frequently does not occur and the abscesses are to all intents and purposes subperiosteal abscesses which will heal promptly when drainage is thoroughly established.

2. It is absolutely impossible to demarcate the healthy from the diseased bone and the mechanical principles upon which the spine is built are so important that it is inadvisable to remove unnecessarily any important part of the structure which the operator might be tempted to do unwittingly in any radical bone removal.

3. When necrosis of bone does occur this will be of minimum size, commensurate with the size and position of the thrombophlebitic lesion, when the natural process of sequestration is allowed to go on undisturbed. The necrotic

portion should be removed from the wound only when it is thoroughly separated, or it can be allowed to discharge itself spontaneously from the sinus at a subsequent period.

Healing is as a rule a protracted affair. Revisions are often necessary and must be repeated sometimes. The usual findings at these revisions are devious and sometimes complicated sinus tracts with or without the presence of sequestra. Some of these tracts wind in and out and around the foramina and various processes of the individual vertebræ. In some of the cases insufficiently drained deep seated pockets are found.

Orthopedic appliances are generally not called for except in cases of osteomyelitis involving the cervical spine.

C. Suppuration or inflammatory exudate within the interior of the spinal canal. This group includes the neurological complications of osteomyelitis of the vertebra and as such forms a distinct therapeutic group inasmuch as the principles of treatment are not determined by the local lesion so much as by the character and extent of the neurological symptoms. The group includes the following:

1. Cases of frank meningitis. At the present stage of knowledge meningitis is for practical purposes a fatal complication. Medical or surgical measures seem of no avail. Recovery is a rare exception.
2. Cases in which the neurological complication consists of a compression of the spinal cord. The indication is to do a spinal decompression (*i.e.*, the removal of the spinous processes and the laminae up to the junction with the pedicles) and to deal with the pathological condition which presents itself. In those with extradural exudate simple decompression is sufficient. In those with extradural abscesses drainage of the latter is necessary in addition. There are numerous instances in which either one of these two conditions, or possibly both, is combined with other pus accumulations outside of the spinal canal and in these the decomposition forms part of the procedure which must be done. The promptness and rapidity with which relief of symptoms follows the decompression indicate in most of the cases of pure compression the promptness with which the complication has been recognized and relieved. Usually the symptoms appear rapidly and with sufficient dominance to make recognition of the complication and its immediate relief a rather simple matter.

A curious condition was found in one personal case. A young child was admitted to the hospital with an abscess of the back close to the median line, the origin of which in the spinal vertebræ was not at first recognized. The abscess was incised and drained and for several days thereafter the convalescence proceeded as it should. Then a clear watery fluid, evidently cerebrospinal fluid, began to escape from the wound. Examination of the wound showed that the fluid came from a narrow sinus which passed inward in the general direction of the spinal canal between two of the laminae. In spite of the fact that there was no possibility of preventing contamination and infection, the escape of cerebrospinal fluid was accompanied by no untoward manifestation and cicatrization of the wound and closure of the fistula proceeded uneventfully until complete healing of the wound.

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3. Cases in which the neurological complication is a myelitis. These are sometimes difficult to distinguish from the cases of pure compression. In any case it seems justifiable to decompress the spinal canal and its contents in the hope that relief will follow.

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CARPAL OSTEITIS

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FROM THE PORTLAND CLINIC

HEREWITH are presented eight cases of osteitis of the carpal bones. Three are definitely traumatic in etiology; three are apparently occupational; in one the cause is unknown, and one, occurring in a child of twelve years, seems to be comparable to Köhler's tarsal scaphoiditis. The clinical signs, symptoms, and course in all have been the same. All began with pain and swelling in the wrist, tenderness on pressure over the bone or bones involved. Stiffness was present in all: in some, slight, in others, marked. Dorsal extension was limited to a greater degree than palmar flexion and passive movement in these directions caused pain. There have been periods of complete and comparative freedom from clinical symptoms, followed by an aggravation of disability, usually without cause.

Of the bones involved the scaphoid and semilunar predominated, but in one here classified as occupational, both wrists were affected and all bones showed X-ray evidence of the destructive process.

The name Kienboch's disease has been applied to this condition when the semilunar alone is affected. Goldsmith has recently reported three cases, and noted one hundred more listed by Finsterer prior to 1909, and later Henderson described two cases and stated that the disability as a clinical entity is usually not recognized, and the objective symptoms may be so slight that a suspicion of malingering may well be entertained. He says: "The syndrome in typical cases is characterized by three stages: (1) the acute, lasting possibly only a few hours, coming on immediately after the injury, rarely lasting more than a few days, and generally not more than a few weeks; (2) the period of freedom from pain and disability, sometimes lasting as long as two months, and (3) the period of actual disease in which the osteitis definitely assumes form and persists with symptoms for years." The X-ray picture is quite typical, but varies as the condition progresses. If taken immediately after injury, or soon after symptoms are noted, no particular change is seen. Early, however, there is an increase of density in the bone. Later, when malacia begins, clear areas appear. The articular cartilage may retain its outline for years before complete crumbling takes place. Disease of the scaphoid has been known as Preiser's disease. Preiser described a post-traumatic osteitis which led to spontaneous fracture of the scaphoid. He concluded that rarefaction preceded the fracture.

It is well known that fracture of the scaphoid and semilunar are followed by osteitis, but in none of the following cases was the original injury severe enough to cause fracture. Two X-rays taken later showed definite fragmentation.

Buchman, in reporting seven cases, calls this disease osteoporosis of the carpal bones. He has found the scaphoid, semilunar, or magnum and unci form involved.

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CASE REPORTS

CASE I.—Miss V. W., twenty years of age. This patient stated that when she was eleven years old she fell on an outstretched hand, injuring her wrist. The only disability she remembers was the inability to play the piano for six months. For seven years the wrist caused no trouble. Then, on account of pain and swelling, she consulted a physician, who diagnosed her condition as chronic sprained wrist. She wore splints for six weeks and has had recurring attacks since that time.

Examination revealed swelling in the dorsum of the wrist, pain on pressure over the semilunar and a marked degree of muscle spasm. The hand was fixed in slight palmar flexion. The X-ray revealed an ovoid rarefaction in the dorsal tip of the semilunar.

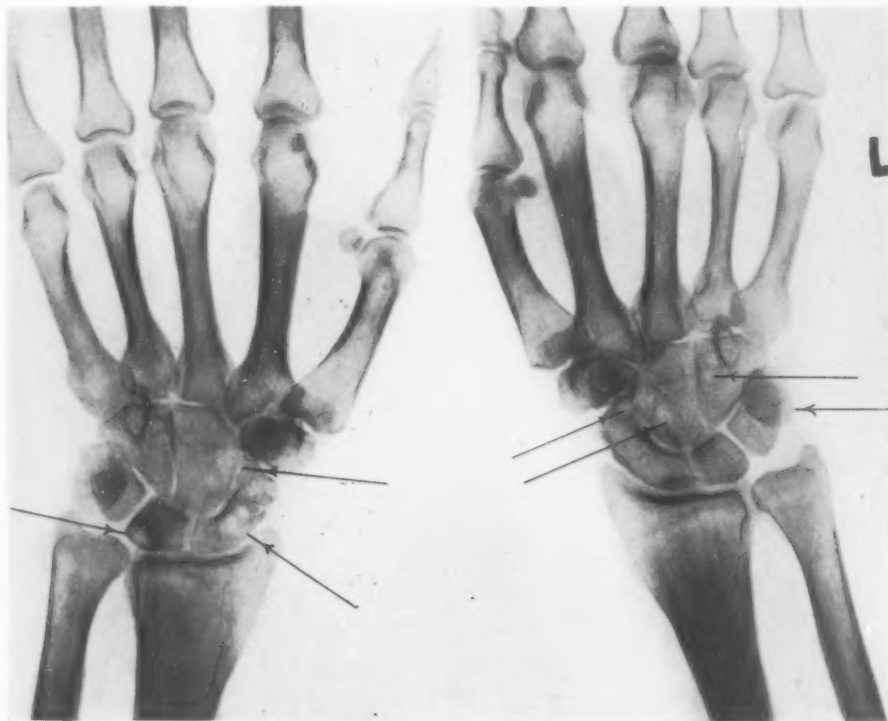


FIG. 1.—CASE III.—Showing cavity formation in all of the carpal bones and bilateral involvement.

There was no evidence of fracture. The bone about the punched out area was denser than normal bone.

CASE II.—Mr. J. K., fifty years of age. While scuffling six months previously patient fell on extended hand. The wrist swelled slightly and was painful, but this soon subsided, and he thought nothing more of it. Four months later he again noticed swelling and had an X-ray taken of the wrist. He was told that the X-ray was negative and that he had a chronic sprain of the wrist.

Examination revealed slight swelling of the affected wrist, pain on pressure over the scaphoid in the anatomical snuff-box, and limitation of movement in extreme limits. He brought his X-ray, taken two months before, and it showed two definite areas of rarefaction in the bone of the scaphoid. A year later definite fissure has taken place and the bone is now divided.

CASE III.—Mrs. J. A. C., a seamstress. This patient has had pain, swelling and stiffness in both wrists for one year. No other joints are or have been involved. The pain comes and goes. The attacks are accompanied by temperature, as high as 101.5° . There is no permanent stiffness. X-ray of both wrists (Fig. 1) showed punched out

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areas in all the carpal bones. This case is unusual in the number of bones involved, in the severity of the attacks which are accompanied by fever, and in the bilateral involvement.

CASE IV.—Mr. W. K., fifty-eight years of age. Automobile painter. This patient presented himself for treatment stating that he caught a steel jack as it was tipping over and sprained his wrist. He also said that the accident causing the injury was a very minor one and he could not account for the severe swelling and pain. Both wrists have been swollen at different times, but he does not recall laying off on account of this.

Examination revealed swelling and pain on pressure over the scaphoid of the right



FIG. 2.—CASE VI.—Showing two large cavities in the semilunar bone, with increased density of surrounding bone.

wrist. Both wrists were X-rayed and in both the scaphoid was found divided. The contiguous surfaces were irregular in outline, the bony structure was quite dense and several rarefied areas were seen. This is apparently an occupational condition; the patient uses both hands continuously in his work, using a cleaning brush with his left hand and painting with his right. The separation found in the X-ray is not congenital, because of the sharp outline of the fragments and the irregularity of their contour.

CASE V.—Mrs. F. B. S., fifty-six years of age. For years this woman had what was called arthritis of the wrist. There were periods of complete freedom from pain, followed by swelling, stiffness, and inability to use the right hand. Two weeks before examination she fell, injuring her wrist severely. The X-ray revealed a fracture of the styloid of the radius and a large cavity in the semilunar. This patient has apparently had an osteitis of the semilunar for a long time, which would no doubt have remained undiagnosed except for the X-ray examination incident to the severe injury.

CASE VI.—K. M., forty years of age. Typist. Pain in the wrist for years, diagnosed by a number of physicians as chronic sprain of the wrist.

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Examination revealed slight limitation of motion, no apparent swelling. Pain on pressure over the semilunar. The X-ray (Fig. 2) revealed a large cavity, involving most of the bone. This patient found it necessary to change her occupation on account of her wrist disability. Later X-rays, after prolonged physiotherapy (diathermy), revealed a filling in of this very large cavity. Clinical symptoms have not recurred for a year.

CASE VII.—Dorothy S., twelve years of age. Swelling of the right wrist noticed by mother for six months. The X-ray revealed a flattened semilunar with increased density and cavity formation. This case has the appearance of Köhler's tarsal scaphoiditis. This may be the type of case that previous authors have compared to Osgood-Schlatter's disease, Legg-Perthe's disease, Köhler's disease, and the osteochondritides. Buchman does not agree with this classification, but this case occurred during active growth and may well be placed in this group. However, I have not been able to find in the literature any case previously reported occurring in the growth period.

CASE VIII.—Miss A. P., thirty-eight years of age. Typist. Injured by falling with outstretched hand against a seat in a railway train. Inability to work at her occupation for three months. Limitation of movement in dorsal flexion. Pain on pressure over the scaphoid. X-ray findings: "There is an irregular area in the scaphoid in which the normal striations are not seen; rarefaction is present. Bone absorption has taken place."

The problem of disability entered into this case. The X-ray findings, though positive, were not clear cut. However, pressure in the anatomical snuff-box caused severe pain, and the patient continued treatment at her own expense after a settlement had been made.

Treatment.—Treatment has consisted of the application of heat by means of diathermy and of immobilization. In some cases treated over an extended period of time we have seen filling in of the bone cavities and the disappearance of symptoms. We have not found it necessary to remove the bones in any case.

This disease is apparently a distinct clinical entity. It is comparatively common and is often overlooked. The X-ray findings of cavity formation are positive proof of its existence, the X-ray being quite distinctive.

Trauma is not the only etiologic factor. Two cases here reported, one with febrile reactions and the other in a child, do not come under this etiologic classification. The term carpal osteitis seems a fitting term to include both the traumatic and non-traumatic types.

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FRACTURE OF THE CARPAL SCAPHOID*

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ALTHOUGH fracture of the carpal scaphoid had been clinically well described over a hundred years ago, it was not until the X-ray increased the accuracy and extent of our knowledge that its study was put on a more scientific basis. No less than thirty years ago Doctor Stimson, before this Society, made the statement that "fracture of the carpal scaphoid was usually attended by complete disability of the wrist." Since that time the serious disability consequent to this injury has led to numerous papers on the subject. The tendency in the past of some surgeons to look upon the result as being inevitably unfavorable is to be deplored. The appropriate method of treatment of this condition awaits more extensive data from the follow-up reports of patients suffering from this injury. For this reason the author wishes to make this report of a group of his own cases, seventeen in number, the follow-up results of which extend from one and a half to ten years.

Occupation.—Five of the cases were firemen, *i.e.*, men exposed to trauma. Otherwise irrelevant.

Age and Sex.—All of the patients were adult males between twenty and fifty years of age.

Mechanism.—The violence in most cases was indirect. The suddenness of the trauma and the attending pain made description of the accident too problematic to be of use. Two types of fracture were present, *i.e.*, (1) those of body; (2) those of tubercle.

At the time of injury it was thought that the usual position of the hand was that of radial or ulnar, as well as dorsal, flexion. This condition was obtained usually in falls on the outstretched hand, especially in backward falls when the hand was dorsally and radially flexed. It has been shown experimentally by Cousin and Gallois and by Hirsch that if the hand was not in extreme dorsal flexion then the relaxed ligaments allow full mobility to all the carpal bones, so that there cannot be a concentration of the force on any single bone. When, however, the hand was in dorsal and radial flexion the scaphoid was fixed in the articular cavity of the radius. The impact of the head of the os magnum into the concave side of this bone, fixed medially by the semilunar and laterally by the trapezoid and trapezium, usually caused it to fracture transversely in its relatively contracted middle diameter. For this reason others have called the scaphoid the buffer bone and its position between the under surface of the radius and the head of

* Read before the New York Surgical Society, January 23, 1929.

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the os magnum as the position of contention. Fractures of the tubercle of the scaphoid are extra-articular and are probably accomplished in the position of extreme ulnar flexion by the dense lateral radial ligament.

Pathology.—Fifteen cases showed transverse fracture through the body of the bone, *i.e.*, all of these were intra-articular. Of the two others one showed a fracture through the tubercle and the other showed a chipped fracture of its outer surface. In none of the cases was there displacement of the bone fragments. One patient showed a large central area of destruction due to comminution. With the exception of two patients who showed three fragments each, all of the other scaphoids were fragmented into two pieces. One patient had had fracture of both scaphoids with about a year's interval.

Symptoms and Signs.—The cases were divided in this basis as *acute*, of which there were eight; and *chronic*, of which there were nine.

History.—Acute Cases.—The usual history of violence was similar to that of a Colles's fracture or a sprain of the wrist. Pain was the most constant symptom. It varied in intensity and while usually very severe it was occasionally so slight as to be misleading. With the pain there was disability especially in pushing from a cock-up position. There was swelling over the outer area of the wrist with obliteration of the snuff-box. Ecchymosis is generally lacking. Tenderness was present in all, being most marked in the snuff-box when the hand is in a position of ulnar flexion. The percussion sign obtained by percussing the head of the middle metacarpal with the hand in radial flexion was not of value to us. X-ray was the most important diagnostic method. As pointed out by Chase and Codman more than twenty years ago, the best results are obtained by X-raying both wrists. The palms are placed downward, in ulnar flexion, with the thumbs together. The tube is centred over the radial styloids. This rules out also the possibility of a bipartite scaphoid being mistaken for a fracture as well as tending to show more clearly the fracture line in doubtful cases.

Chronic Cases.—There were nine in number. Eight of these had been diagnosed as sprains of the wrist. The ninth was discovered in the course of an X-ray for another purpose about five years after the injury. The history, when it was remembered, was usually that of a so-called sprain of the wrist.

None of these cases had either the benefit of X-ray or immobilization, although all but one were treated by physicians. Varying degrees of persistent discomfort or pain in the affected wrist, stiffness and disability were present in all but two cases from a slight amount to almost complete loss of function. These latter two cases showed only slight pain, but no limitation of function. On examination there was tenderness, as a rule, present in the snuff-box. One patient showed marked bony crepitus. Limitation of function was present in seven out of the nine patients varying from a slight degree to almost complete stiffness at the joint. The X-ray of these chronic cases was characteristic. The line of fracture was distinctly seen in all as bony union had failed to take place. The pathological changes which have

been so often described were seen variously in these X-rays. Rarefaction of the fragments, loss of substance, cavity formation and adjacent osteo-arthritic changes were present in varying degrees. As Speed has pointed out, extreme pain and almost complete disability may follow fractures without any apparent osteo-arthritis. Conversely in two of these patients there were very marked pathological changes present with only slight degree of pain and lessened function resulting. (Fig. 1.)



FIG. 1.—Watchman, aged sixty years. Untreated fracture five years after probable occurrence with failure of union in the three fragments. The patient had little discomfort and only moderate loss of function and power. The bony fragments, however, showed the most extensive degenerative changes. There were no changes noted in the adjacent carpal bones. The pathological picture was out of all proportion to the relatively slighter clinical findings.

from six to eight weeks. Most cases were treated for the latter period. This time was selected from the standpoint that active bone repair in the scaphoid, especially in intra-articular fracture, is much less active than in fractures of the long bones. Protection during this period of repair must be maintained until union has definitely progressed. The two fractures of the scaphoid tubercle since they were extra-articular and required less protection were immobilized for periods of three weeks respectively. Following the removal of the splint physiotherapy was used when possible as an adjunct in the stage of convalescence. The treatment of these cases by this method was too casual to draw any conclusions.

Results.—Acute Cases.—Both fractures of the scaphoid tubercle obtained the usual excellent result. When examined one year after their injury there was no evidence of any pain or disability. X-rays were not taken at follow-up. The six remaining acute cases of fracture of the body were examined and X-rayed from one to eight years after injury. X-ray showed three cases to have bony union. These patients were symptomless and showed

Treatment.—Acute Cases.—Every case with the symptoms or signs suggesting this injury was immediately X-rayed. Of the eight cases all were seen from within a few hours to thirty-six hours after injury. On confirmation of the diagnosis they were immobilized in either bilateral moulded plaster splints or in a split roller case. The plaster was carried from the tips of the fingers to the elbow. The thumb was abducted and the wrist was put in the cock-up position. The period of immobilization varied

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excellent function. These surprising results were obtained in city firemen, all of whom were able to resume their full occupation within four months after their injury. The other three acute cases showed failure of bony union. There was only slight disability and no discomfort present in this latter group. One of them, a professional pugilist, was able to carry on within six months with about 10 to 15 per cent. diminution of function; another, a physician, at the end of eight years has only slight discomfort and no disability, although this last patient's X-ray shows distinct bony changes in both fragments of his scaphoid. (Fig. 2.)

The poorest result was that of a patient whose limitation of function was about 25 per cent., but in view of his moderate discomfort he was willing to tolerate this condition rather than be subjected to any operative procedure. The lack of symptoms and the good function obtained by the early treatment of these cases even when bony union is not obtained seems inconsistent with the X-ray picture. Possibly union may be present, although it may not be bony union.

Treatment.—Chronic Cases.—There were nine: five were non-operative; four were operative.

Non - Operative



FIG. 2.—Eight-year-old fracture treated by immobilization in acute stage with failure of bony union and definite changes in both fragments and adjacent osteoarthritis. The patient has no pain and no loss of function or power. This illustrates difficulty of forecasting clinical findings by mere examination of the X-ray.

Group.—One of these patients with non-union, following an untreated fracture of several years' standing, refused operation. Conservative immobilization did not diminish his symptoms of discomfort and mild disability. He is classified as a poor result. Another of these patients had been injured twenty years previously and had been treated only with a wrist band over a period of several weeks, having been told that he suffered from sprain of the wrist.

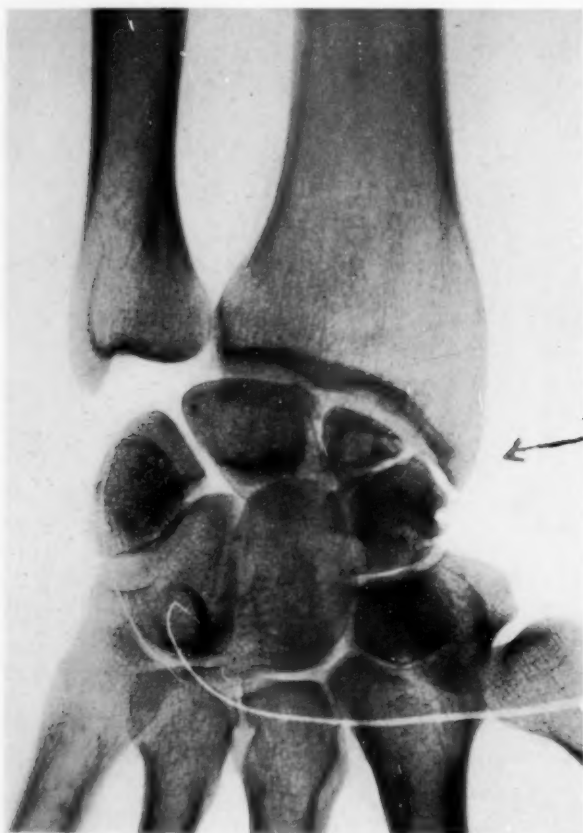


FIG. 3.—A twenty-year-old untreated fracture with failure of bony union. There is extensive bony change in both fragments with osteoarthritic changes also evident. In spite of this pathological picture the patient has no pain and only slight loss of function in extension. His wrist power is not impaired.

Here there were only slight limitation of function and mild discomfort, although his X-rays showed extensive bony changes in both fragments with evident osteoarthritis. The pathological picture is out of all proportion to the functional and symptomatic result. He is content, in view of the fact that nothing could be gained by operation, to have no treatment. (Fig. 3.)

Three others examined from one to five years after their injury showed moderate pain and moderate loss of function. In view of the fact that they all had sedentary occupations, they were willing to tolerate their condition since only operative treatment could be advised.

Operative Group.—

The four remaining chronic cases were treated by operative measures. The earliest one of this group was treated by excision of the small proximal fragment. The result three years later showed that although his pain had disappeared his function was unimproved. A following X-ray taken immediately post-operative showed a small bony shadow in the capsule at the site of the removed fragment. Three years later this area had grown distinctly and the presence of crepitus on active and passive motion indicates that this may be a remote cause of further disability. (Fig. 4.)

There is, however, no change in the X-ray appearance of the remaining

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fragment or in that of any of the other carpal bones, although the prevailing opinion amongst writers on this subject is that all fragments of the injured scaphoid undergo progressive osseous degeneration. The three other chronic cases were treated by removal of all fragments. The most dominant symptom in these cases was pain and all of them received early and permanent relief from this symptom following the operation. The relief of chronic pain seems to me to be the real indication for operative removal of the bone fragments. Function, unfortunately, may not be similarly improved. (Fig. 5.)

One must be careful not to be too sanguine of improving the range of motion or the strength of wrist power in these chronic cases by excision of the fragments. In two of these complete excision cases small areas, evidently bony shadows, were noticed in the capsule post-operatively. They were thought to be the result of the removal of the adherent fragment which is often large and on account of its dense attachment to the sur-



FIG. 4.—Chronic case of fracture with failure of union and severe resulting pain. The proximal fragment was removed easily. An X-ray taken post-operatively showed a small shadow, evidently a bony deposit at the site of removed fragment. This is shown by the arrow to have increased about two-fold in the past five years. The pain for which removal was performed was relieved and has not recurred, although this bony deposit is much larger.

rounding ligaments involves the risk of leaving small collections of bone cells behind. X-ray taken later in both of these cases at a period of six months and of two years, respectively, showed no change in either of these cases. It is thought possible that the growth of such small bony foci may tend later to diminish the apparent good result. (Fig. 6.)

Prognosis.—The prognosis in fractures of the tubercle of the scaphoid as shown in these two cases and in many other case reports is usually good. In this type of bony fracture union is to be expected. The prognosis in fractures of the body of the scaphoid is, however, quite a doubtful matter. Increasingly it has been brought home to surgeons that the disability resulting from this injury may be a major one. In this small series more than 50 per cent. of the cases are termed chronic, due to failure of early recognition and treatment of the condition. The recent or acute cases were mostly in firemen who, on account of competent medical supervision, sought advice very

soon after their injury. The favorable results of this small group of cases, functionally and symptomatically, surprised the writer as they were quite contrary to what is usually expected. The follow-up X-ray of three out of six acute or recent fractures of the body of the scaphoid showed apparent bony union two to two and one-half years later after their injury. This high percentage of bony union, if one judges by other case reports, is unusual.

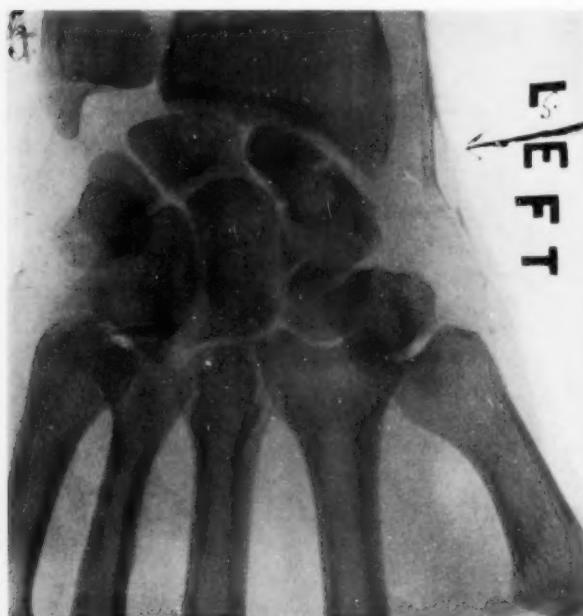


FIG. 5.—Acute case of fracture with adequate treatment that was a clinical failure. The large central shadow at operation was not found to be a cyst, although the X-ray is suggestive. This patient's pain was relieved by removal of both fragments, but his function and power were not improved. The X-ray picture simulates that described under the title of Traumatic Osteo-Porosis of the Carpal Bones. The operative finding did not bear this out.

union only in one case, that of a young boy. Blau and Graniers have reported almost complete disability in seven out of twenty-one soldier cases, in their separate reports. They stress that fractures of this type uniformly offer a very poor prognosis. We feel, however, that the relatively high percentage of bony union in our acute cases should awaken a sense of more hopeful prognosis. The tendency to too early operative treatment should be discouraged.

With the excellent X-ray facilities at our disposal there can be no argument against the more routine use of this instrument in all cases of severe wrist injury. If an X-ray is not immediately obtainable it is wiser to suspect fracture and treat these cases accordingly. Bony union is possible, but it is improbable except in extremely favorable cases. The usual opinion that bony union occurs rarely, must not prevent one from taking the earliest adequate, protective measures. Experimentally in dogs, Johnson has shown "that while bone repair does take place it is less active than in

The failure of bony union in fractures of the scaphoid has led to much conjecture, the ascribed causes varying from the deleterious effect of the synovial secretion on osteogenesis to the more understandable reason of faulty nutrition following the complete interruption of the fine arterial branches supplying this bone. Failure to protect these fine vessels by early and adequate immobilization is believed, by some, to be one of the principal factors in causing failure of bony union. Speed has stressed repeatedly the uniformly poor results in this fracture. He states that he has seen bony

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other bones. The zone of repair is less extensive and the fracture hyalin cartilage is healed by fibrous tissue." Also Adams and Leonard report a chronic case of fracture with non-union treated by a bone graft from the tibia. It was shown six months later that partial bony union had taken place and that the patient, a prize fighter, was able to strike blows without feeling any resultant pain. The prognosis in cases of recent fracture that fail to get bony union, provided they get early diagnosis and treatment, is symptomatically and functionally better than the X-ray appearance of the wrist would lead to believe. This is shown by the follow-up X-rays of our ununited recent cases taken two to eight years later. The X-ray appearance would lead one to suspect results much poorer than were obtained. By illustration, one patient, a physician, suffered a fracture of the body of the scaphoid about eight years ago. He was immobilized for six weeks at the time of injury. Follow-up X-ray shows failure of bony union with marked change in each fragment. There is also evidence present of osteoarthritis adjacent to his fracture. In spite of this dubious X-ray the

symptomatic and functional result is very good. Possibly in these cases instead of showing lack of bony union there is fibrous union.

Chronic Cases.—The outlook of these cases is unfavorable. There is usually non-union of the fragments with bony degeneration and adjacent osteoarthritic changes. Pain and disability usually attend this result. Operative treatment is indicated in selected cases.

Chronic cases attended by pain as the most prominent symptom are the type most benefited by operation. The relief of pain is early and as a rule



FIG. 6.—X-ray taken after removal of ununited fragments of fractured scaphoid. Four small bony deposits are shown probable in the surrounding capsule. Following X-ray taken six months later showed all but one to have disappeared. These deposits are possibly left behind after the removal of the adherent distal fragments.

complete. We are not impressed with improvement in function in these cases after removal of the scaphoid fragments. Most of our cases showed either very little or no improvement in function after operation.

The question of whether to remove one fragment as was suggested by Codman, or to remove all as advocated by Hirsch, Speed and others, seems to be adequately answered in favor of the latter slightly more difficult procedure, in view of the continuous pathological changes in the retained fragments that may later give rise to symptoms. The adherence of the distal larger fragment to its surrounding ligaments makes its removal at times distinctly more difficult than the free intra-articular fragment.

CONCLUSIONS

1. Patients with fracture of the tubercle of the scaphoid obtain as a rule favorable results.
2. Early recognition and adequate treatment offer the only chance for bony union in fracture of the body of the bone.
3. Favorable results in fracture of the body of the scaphoid may be obtained in cases which are recognized and treated in the acute stage, although bony union may not be obtained.
4. The chronic cases are unusually the unrecognized ones.
5. Certain chronic cases, especially in people of sedentary occupations, have so little pain and disability that they are best let alone.
6. Chronic cases with persistent pain offer the best results to operation.
7. Function or wrist power may not be improved in the chronic cases by operation.
8. The patient's symptomatic or functional result cannot always be forecast by examination of the X-ray in either the early or the late cases.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD DECEMBER 12, 1928

The President, DR. FRANK S. MATHEWS, in the Chair

ECHINOCOCCUS CYST OF LIVER

DR. FORBES HAWKES presented a man, forty-eight years of age, born in Germany, living for the last thirteen years in the United States. His previous history was irrelevant except that in 1907, while on an Italian steamer at Naples, he had, together with many others on board, an attack of dysentery with bloody stools from dirty drinking water. He was in the Hamburg Hospital then for seven weeks, but left there apparently cured. Except for slight indigestion at times he felt perfectly well until April 20, 1925, when he was seized with upper abdominal pains and cough. His family physician then examined his chest and found some râles behind, over both bases, but these disappeared in a few days. His liver was enlarged and his temperature varied from 100-103° F. with profuse sweating. On April 29, 1925, he had a chill. No urinary symptoms. On April 30, 1925, when first seen by Doctor Hawkes, he presented a firm mass to the left of the epigastrium, which felt like an enlarged left lobe of the liver. This mass was tender. His abdomen was tympanitic. A few râles were heard over the left base posteriorly. He gave the history of having several years previously paid a large sum for an imported police dog and had often allowed this dog to lick his face. A tentative diagnosis was made of echinococcus cyst and he was referred to the Roosevelt Hospital. His blood count there was 14,000 leucocytes; 78 per cent. polymorphonuclears; No eosinophiles. X-ray of chest was negative. His temperature subsided in a few days, but the mass remained about the same. Exploratory laparotomy was done May 7, 1925. The left lobe of the liver was found greatly engorged, and projecting downward was an inflammatory elevation which was covered with only a few cobwebby adhesions. The other organs in the vicinity seemed normal. It was deemed unsafe to open this collection until more adhesions had formed so a gauze strip was placed around the inflammatory elevation. An aspirating needle was passed into the liver for about three inches through a markedly thickened liver area, withdrawing several drops of whitish pus. The pathological report on this pus was "pure colon bacillus cultures. No hooklets." May 11, 1925, the collection was opened, revealing hundreds of echinococcus cysts. An attempt to enucleate the sac was followed by such profuse bleeding that this was given up and the wound packed with plain gauze. There was some shock following this operation, but he quickly rallied. The next day the packing in the cyst cavity was removed and many cysts started to come out. The cavity was then irrigated with a solution of tincture of iodine 1-100 (1%) in order to kill the smaller cysts within the sac. This irrigation was done daily and hundreds of small cysts were washed out in this way, deeply stained with the iodine. At the end of six days the cavity held about six ounces and a rubber tube was introduced in order to prevent the mouth from closing. June 16 irrigation floated out what

ECHINOCOCCUS CYST OF KIDNEY

seemed to be a portion of main cyst wall, deeply stained. June 26 two similar bodies floated out and July 20 a large and heavy piece appeared followed by smaller ones. The last ones to appear were about August 15. The tube was then shortened gradually so that by November 6 the sinus was only an inch deep. The tube was then left out, the sinus closing November 13. He had regained his weight to 145 pounds. He stayed perfectly well then for almost three years, until this summer when he was attacked while abroad with pains in the region of the old cyst. Through an opening made in the old scar was extracted what was probably the remains of the old cyst wall. Four or five days after this he was seized with sharp pains over the gall-bladder region and in the back with jaundice. An acutely suppurating gall-bladder without stones was removed. He made an excellent recovery and seems in perfect health now.

Pathological report on specimens removed May 11, 1925. The specimen consists of a basin filled with small cysts, blood, and débris. The cysts vary in size from small objects a few millimetres in diameter to larger ones five centimetres in diameter. Besides these there are some collapsed remnants of cysts that must have been ten centimetres in diameter before their contents were lost. The mass of the specimen with the blood strained out just fills a quart jar and a rough estimate puts the number of cysts, two centimeters in diameter or over, at about one hundred. The smaller cysts and collapsed envelopes appear to be innumerable. The smaller cysts are thin walled, colorless, quite transparent and filled with a perfectly clear fluid. The larger ones show a slight opacity over part of the circle. Finally, in the still larger ones, the internal surface shows definite granular areas and even cauliflower-like projections of tissue, one centimetre in height and several in diameter.

The sections of the walls of these small cysts show merely faintly striated pink-staining glutinous material without evidence of budding daughter cysts or scolices. In a few places the margin of the section is covered by a faintly granular material containing blood cells and leucocytes.

ECHINOCOCCUS CYST OF KIDNEY

DR. FORBES HAWKES presented an Armenian woman, thirty-nine years of age, who had come to this country two and one-half years ago from Armenia. Her previous history was irrelevant except that four years ago while in Armenia she noticed a lump in the right upper abdomen. This lump gave her no pain, but grew slowly in size. The family had kept a dog in Armenia and later information revealed the fact that owing to their poverty it was customary with them, as with many others, to collect ordinary grasses from the fields for food. This patient was referred to Doctor Hawkes by Dr. J. Dearden November 17, 1927. She then presented a roundish tumor just below the lower edge of an enlarged liver, roughly three inches in diameter, not tender, dull to percussion. Urine negative except for a few white blood cells. Blood count, 12,000; white blood cells; 70 per cent. polymorphonuclears; 23 per cent lymphocytes; 6 per cent. eosinophiles; 1 per cent. basophiles.

X-ray films of chest showed no evidence of any metastatic processes in lungs or pleura. Films of abdomen showed a large mass in upper right abdomen continuous with liver shadow; the appearance being one of a very definitely enlarged liver. The right kidney was obscured either by the liver shadow or by involvement of the mass. The right diaphragm was not higher than normal. The lower border of the mass extended down to the fourth lumbar vertebra on the right side. There was no evidence of any change in the spine or the ribs.

At operation at the Fifth Avenue Hospital November 25, 1927, a very large right kidney mass was found, the echinococcus cyst occupying about nine-tenths of the tumor. Very hard adhesions bound it to the liver above and to the cellular tissues behind. The vessels at the hilus of the kidney were small and the ureter hardly recognizable as such. No cysts were felt in the liver. The gall-bladder was normal. The spleen did not feel cystic. Left kidney normal. The structures in the female pelvis felt normal. The tumor was too large a one to admit of removal through a posterior incision so that an abdominal nephrectomy was performed, with a cigarette drain to Morrison's pouch. Following the operation the urinary output was adequate. There was, however, more bleeding from the old adhesions than the drain would take care of. This resulted in a deep collection of blood which broke down and was evacuated through a lumbar incision about three weeks after the original operation. She then went on to uneventful recovery. She has had no further abdominal or renal symptoms of note. The pathological report is as follows:

Macroscopical Examination.—A. Separate piece of tissue, thought to be from one adrenal, is two centimetres long, one millimetre thick, one centimetre broad, yellow in appearance and on section resembles an atrophied adrenal. B. Specimen has appearance of a cyst measuring 17 x 15 x 10 centimetres. At one edge there is the structure of a kidney which is ten centimetres long, the cyst appearing to have developed in its capsule. On opening the cyst the kidney itself shows a cyst 5x4½ centimetres extending from the hylum outward in what would be the region of the pelvis with an atrophied kidney on either pole. This cyst is filled with small grape-like bodies, which are translucent bodies. The appearance of these cysts is typical of echinococcus.

Microscopical Examination.—Tissue from surface of cyst shows the structure of the adrenal. Section through the wall of the two cysts and the remains of the kidney shows atrophy of the kidney tubules and a very marked cellular infiltration which is made up almost entirely of eosinophiles. Sections of the cyst wall show dense fibrous tissue which in the case of some of the smaller cysts shows the characteristic lamination. Examination of the unstained cysts shows the laminated cyst wall and within the cyst many scolices, also cholesterol crystals lying free in the fluid.

DR. WALTER A. SHERWOOD stated that several years ago he presented before the society two cases of echinococcus cyst of the liver which he had observed and cared for in the Brooklyn Hospital. Two other cases were later observed since which time he had never seen another. The interesting part of these four cases was that in each it was thought that the etiology could be traced to the association of the patient with sheep dogs. All four patients were foreigners, one an Italian, two were Greeks, and one an Armenian, and in each, by careful questioning, it was found that they came from families closely associated with sheep herders and all had lived with or slept in the same room with sheep dogs, which is supposed to be the most common means of the transfer of echinococcus parasites from dog to man.

All were typical cases and a radical operation was done in each in one or more stages. Convalescence in two cases was very stormy. In these there were many complications: two developed empyema of the thorax and all but one required two or more secondary operations before they were well. Up to that time this was the only type of liver cyst he had seen.

COMMON-DUCT STONES

Recently, however, he operated on a man sixty years of age who had been under his observation for a long period of time because of digestive disturbances. In spite of careful study they were unable to make a diagnosis, but finally the patient appeared with a large mass in the abdomen the size of a huge watermelon, complained of loss of weight and increased digestive disturbances. Examination before operation showed a large cystic tumor occupying the entire right upper and mid abdomen with the stomach crowded well over to the left side. At operation the cyst was found to have had its origin in the region of the falciform ligament of the liver. It contained nine quarts of clear yellow fluid, which on examination showed nothing but a trace of albumin, specific gravity of 1015 and no parasites of any sort. This cyst occupied the subdiaphragmatic space, was contiguous with the liver, pushing it downward and to the left, the right kidney downward toward the mid-line and crowded the stomach well over to the left side. The cyst was drained by means of a trochar and canula, and part of the sac wall was removed and then brought up into the upper angle of the abdominal wound and sutured there. A large rubber tube and gauze packing were introduced. The remainder of the cyst wall was covered with large tortuous veins and it was felt that any attempt to completely remove the sac might result in severe hemorrhage. The liver itself seemed entirely normal.

DOCTOR SHERWOOD asked if any other member of the society had encountered this type of liver cyst.

COMMON-DUCT STONES

DR. KIRBY DWIGHT presented a woman, forty years of age, who entered the Roosevelt Hospital June 28, 1926, with a history of repeated attacks of gall-stone colic. Her history of abdominal pain went back twenty years: always in the right upper quadrant, colicky in character, at times very severe. She would have attacks every four months. No jaundice. Between the attacks she would be well except for gaseous eructations. For three weeks before admission she had had repeated attacks of this pain, very severe, brought on by eating. The pain began in the right side and radiated to the back.

On admission she had a temperature of 101.8° F. with a white count of 9500, polynuclears 72 per cent. In two days her temperature was normal. Physical examination was essentially negative, no tenderness or masses in the abdomen, no jaundice.

A few days after admission jaundice began to develop. It deepened, and a few days before operation the icterus index was 86. Blood clotting time nine minutes. A gall-bladder visualization test after phthalein dye failed to show the gall-bladder. After the administration of fifty cubic centimetres of 1 per cent. calcium chloride solution intravenously on three successive days she was operated upon July 17.

The gall-bladder was small; its walls thickened. It was very closely adherent at its fundus to the first part of the duodenum. It contained two calculi, round, mottled, of the mulberry type; one about one centimetre in diameter, the other about seven millimetres. There were a few irregular facets on them. The larger one was in a little pocket at the fundus and was

apparently just about to ulcerate through into the duodenum at the site of the dense adhesion. The other was loose in the gall-bladder. The cystic duct was much dilated, enough to admit a finger, and was very short. The common duct was greatly dilated due to a large calculus, about two centimetres in diameter, which was impacted in it behind the border of the duodenum. The hepatic ducts were dilated. They were explored with probe and finger, but no calculi found. The common duct distal to the stone was normal and a probe was passed through into the duodenum.

The incision was a right rectus one, with reflection of the rectus muscle outward. The adhesion between the fundus of the gall-bladder and the duodenum was so dense that separation could be accomplished only by amputating the tip of the gall-bladder. The bit of mucous membrane left attached to the surface of the duodenum was curetted away. The gall-bladder was evacuated and a cholecystostomy done. Then the descending duodenum was mobilized and access gained to the common duct at the site of the calculus. The duct was opened, the calculus removed and the duct closed again, by the Mayo method, with a gauze wick tied over the suture line. This drain, covered with rubber tissue, and the tube from the gall-bladder were brought out through a puncture opening in the rectus muscle.

For two days following operation the patient had a stormy time, but recovery was excellent after that. She was discharged on the thirtieth post-operative day.

For five months the patient was free from symptoms. Then, January 11, 1927, she had a severe attack of colic and returned to the hospital the next day. She was jaundiced, with an icterus index of 32; clotting time of nine and one-half minutes. Calcium chloride was administered as before and January 24 she was reoperated upon. The first part of the duodenum was buried in adhesions and was not seen. The gall-bladder was contracted. No calculi could be felt in it. The common duct was dilated, but not so much so as at the time of the previous operation. When it was opened the finger could not be introduced into it. There was a small calculus of the mulberry type about seven millimetres in diameter, impacted in the papilla of Vater, or just proximal to it; its surface was mottled and irregular, with several facets which appeared to be old; probably a calculus which was present, but not found at the time of the first operation. A probe was passed into the hepatic ducts, but no further calculi were found. The pancreas was normal. It was found impossible to work the stone up into a more accessible portion of the common duct, so a transduodenal choledochotomy was done, and the calculus extracted, enlarging the opening in the papilla of Vater. The anterior wall of the duodenum was closed with three layers of tanned gut. The common duct was drained through the incision made in it for exploration.

These procedures had taken so much time that it was not considered wise to remove the gall-bladder.

The patient was very sick for about three days after operation, but then her general condition began to improve. The local condition, however, began to look serious. There was a profuse discharge through and around the drain to the common duct, and the drainage contained not only bile, but duodenal contents. There was a great deal of skin irritation and the discharge had a pungent odor.

By the seventh post-operative day there was evidently a duodenal fistula in full swing, with a profuse irritating discharge digesting the abdominal wall. This did not last long, however. In a few more days the discharge

GUNSHOT WOUND PERFORATING ASCENDING COLON

began to decrease in amount, and by the fifteenth day the discharge was moderate in amount and non-irritating; and the wound began to heal.

This then was not a true duodenal fistula, but a back flow of duodenal contents up the common duct and out through the drainage tract. Later, by some mechanism not quite clear, this back flow stopped and the drainage tract began to heal, and the patient was discharged on the twenty-seventh post-operative day.

Since then she has had no further attacks of pain or any other symptoms referable to the bile tract, but in January, 1928, she began to have the classical symptoms of diabetes. In April she returned to the hospital for examination and was found to have a glycosuria and a blood sugar of .20.

This patient is shown as a case of residual common-duct stone after a choledocholithotomy. This calculus, which remained after a very thorough exploration of the common and hepatic ducts, was probably lying in one of the distal hepatic ducts, too far up and around too many curves to be found by finger or probe. As Doctors Counseller and McIndoe have shown with their corrosion specimens of the liver, in common-duct obstructions there is a wide dilatation of all the radicles of the hepatic ducts. With a patient in the supine position on the operating table it would be an easy matter for a small round stone to gravitate into one of the more distant branches and thus be out of reach of finger or probe.

She is also shown on account of the very interesting pseudoduodenal fistula with its spontaneous subsidence. It was evidently a mistake to drain the common duct after the sphincter of Oddi had been incised.

DR. ALLEN O. WHIPPLE called attention to the cases in which the stone in the dilated common duct could be felt, but in attempts to remove it the stone was found to disappear in the upper part of the duct. In order to meet such an emergency he had found it of real value to press on the right and left lobes of the liver as a manœuvre to bring the stone down into the lower part of the duct system where it could be removed by forceps. In his experience this manœuvre had proved effective where irrigation and manipulations of the forceps had failed to locate the stone.

GUNSHOT WOUND PERFORATING ASCENDING COLON

DR. KIRBY DWIGHT presented a man, thirty-two years of age, who was brought to the Roosevelt Hospital August 6, 1922, suffering from a gunshot wound of the abdomen. He had been shot with a revolver one hour before admission. He was in moderate shock, with a pulse of 120, and was doubled up in acute pain. His abdomen was scaphoid in shape, and was rigid. The wound of entrance was in the right lower quadrant at about the level of the anterior superior spine; there was no wound of exit.

He was operated upon at once, using gas-ether anaesthesia. On opening the abdomen through a right rectus incision, a large amount of blood was found in the peritoneal cavity; but no gas or intestinal contents were encountered until some loops of small intestine were drawn away from the ascending colon, against which they were pressed; then there was a gush of gas and of liquid faecal matter into the peritoneal cavity. There were no adhesions between these loops of small intestine and the colon; they merely lay adjacent to it and yet they had prevented any gross soiling of the peritoneum. There were four holes in the ascending colon and cæcum.

two on the anterior surface, one on the medial and one on the posterior. The blood supply of the gut was compromised by injury to the branches of the right colic blood vessels.

Although the patient's condition was none too good, a resection was decided upon. The cæcum, ascending colon, and hepatic flexure were mobilized. The terminal ileum was divided between clamps, the proximal end was inverted and a side-to-side anastomosis was made to the middle of the transverse colon. The patient was doing badly; the anastomosis was a hasty one and not secure against leakage if there should be any distention of the gut at its site. Consequently the gut to be resected, after it was completely freed, was brought out at the upper angle of the wound, leaving in the abdomen only about two inches of transverse colon proximal to the enterocolostomy. It was sutured in place and the wound was closed around it.

The purpose of this procedure was to save the time that would have been consumed in closing the stump of the transverse colon; and also to minimize the chance of leakage from the anastomosis. The colostomy stoma was only about three inches from the enterocolostomy and so there could not be any pressure inside the gut at that point. There was very little discharge of faecal matter through this colostomy opening; nearly all of it, for some reason, passing the other way on entering the transverse colon.

The patient recovered from the shock of the injury and of the operation. He did not develop peritonitis or secondary peritoneal abscesses, as he should have done, considering the amount of contamination at the time of operation; but his recovery was delayed by the development of an abscess around the bullet, which had lodged in the erector spinæ muscle. This abscess extended downward between the psoas and iliacus muscles and was found with some difficulty. A pneumonia, which came on a few days after his temperature had returned to normal following the drainage of the abscess, still further delayed his recovery.

An attempt to close the colostomy stoma was made October 6. It was partially successful. Another attempt was made a month later and this time we succeeded.

The man has been well, has had no diarrhœa or other digestive symptoms. There is a moderate ventral hernia, but it does not seem to bother him much.

ILEOCÆCAL INTUSSUSCEPTION DUE TO POLYP

DR. HAROLD E. SANTEE presented a man, sixty-two years of age, who was admitted to the Bellevue Hospital February 19, 1927. He had suffered for the preceding two weeks from cramp-like pain in the abdomen. At the onset this cramp-like pain was accompanied by nausea and vomiting, followed quickly by a profuse diarrhœa. After one week, however, nausea and vomiting ceased and the bowels became constipated, so that enemas were necessary. During the entire two weeks cramp-like pain without localization persisted and marked anorexia succeeded the vomiting.

His previous history showed nothing relevant to the present condition—in fact, the present attack followed a long period of particularly good health and good feeling.

His abdomen was lax walled, soft, with no distention. In the right lumbar gutter could be palpated a smooth, freely movable, slightly tender, fusiform mass extending up the gutter almost to the costal margin. Below this could be palpated a distended segment of bowel assumed to be cæcum. Temperature, pulse and respirations were normal. A stool examination on two occasions was negative for blood. A barium enema showed a marked delay in the passage of the mixture beyond the hepatic flexure. However, the

ILEOCÆCAL INTUSSUSCEPTION DUE TO CARCINOMA

hepatic flexure finally filled out regularly. During observation for one week in the hospital, the patient continued to have intermittent attacks of cramp-like pain and distention which, however, were much relieved by enemata and colon irrigations. During this time, the tumor mass was always present, but seemed to vary somewhat in size and consistency.

March 2, 1927, the abdomen was opened through a right lower rectus incision. The mass in the right lower quadrant was first interpreted as a herniation of the terminal ileum into a retrocæcal fossa because the finger could be so easily passed about the intussuscepted gut. The nature of the lesion was quickly recognized, however, and by gentle traction the ileum could be easily delivered backward. Only a thin layer of fibrin covered it and circulation was excellent. About eight inches were intussuscepted. On examination for a possible cause for the intussusception there could be palpated within the lumen of the ileum about eight inches from the ileocæcal valve a soft, "meaty" feeling tumor about the size of the thumb. This could be milked back and forth within the lumen of the gut for about four inches. Fixation to the wall was assumed and a longitudinal incision in the ileum showed a pedunculated, soft, polypoid mass such as had been felt through the wall with a small pedicle attached to the mesenteric side of the gut. This was ligated and the mass removed. The ileum was then closed with a double row of fine chromic sutures and the apparent cause of the intussusception having been removed, no further procedure was done. The wound was closed in layers without drainage.

The patient made a slow but satisfactory convalescence. A small colon bacillus superficial abscess developed in the wound and was opened on the eighth day. The wound was then Dakinized down to the fascia. A cystitis was troublesome for two weeks. On discharge April 15, 1927, he was again in excellent general condition and has remained so since.

Pathological examination of the growth by Doctor Symmers demonstrated a mucous polyp.

ILEOCÆCAL INTUSSUSCEPTION DUE TO CARCINOMA

DR. HAROLD E. SANTEE presented a man, forty-nine years of age, who was admitted to the Bellevue Hospital January 24, 1928. His previous history stated that he had been diagnosed as having pulmonary tuberculosis in 1923; had been in bed for seven weeks with a pleurisy with effusion in 1926; and had suffered from dyspnoea on exertion for one year previous to admission. For ten months prior to admission this patient had been troubled with cramp-like pain across the lower abdomen, particularly after each bowel movement. Between such attacks, slight "cramps" might occur or there might be complete cessation of pain, but as time elapsed mild "cramps" became more frequent and were felt particularly in the right lower quadrant of the abdomen. Two months before admission a sharp attack of diarrhoea with bowel movements almost every hour lasted for two days. Some vomiting occurred at this time. No blood or mucus or tarry stools were ever noted. Coincident with these local symptoms the patient had gradually lost seventeen pounds, had noticed an increasing dyspnoea and an increasing pallor and weakness.

Examination showed a fairly thin, obviously anæmic-looking individual, apparently chronically ill, weighing 116 pounds. The chest showed a localized area at the right base where fine crepitant râles were constantly heard. The abdomen was soft and easily palpated. In the right lower quadrant could be felt at times a firm, movable, slightly tender mass about two inches in breadth and four inches in length. At times this mass would almost disap-

pear and at other times became larger. It not only varied markedly in size but also in position and under manipulation could be pushed easily into the left lower quadrant, over to the left of the umbilicus, or almost under the right costal margin. The patient's temperature, pulse and respirations were normal. The urine was repeatedly negative. The stools under dietetic restrictions showed blood by the guaiac test. The Wassermann test was negative. Blood examination showed hæmoglobin 63 per cent., red blood cells 3,700,000, white blood cells 9000 with polymorphonuclears of 67 per cent., lymphocytes 33 per cent. Two weeks later, hæmoglobin and red blood cells were somewhat further reduced. Röntgenological study showed fibroid changes at the left apex and no organic change in stomach or duodenum. Following administration of a barium enema, the colon examination revealed an irregular filling defect involving the cæcum, suggesting the presence of malignant infiltration. Following a clinical conference on the case, a second bismuth meal was given and it appeared to pass normally through the large bowel. A second barium enema confirmed the filling defect involving the cæcum with the suggestion that it might be due to tumor formation and the possibility that the defect noted might be the result of an ileocæcal intussusception.

Operation on February 27, 1928, was done under spinal anæsthesia until the sew-up, when some gas-oxygen was used. Exploration through a lower right rectus incision revealed a cæcum and terminal ileum intussuscepting into the ascending colon with adhesions and beginning peritonealization of the margins of the intussusception. The terminal ileum proximal to the intussusception was bound down to the posterior wall of the pelvis and its brim by an abnormal fold of peritoneum, apparently developmental in origin rather than pathological. Within the intussusception was a hard, rounded, nodular mass the size of a small orange. One enlarged gland was found on the posterior wall of the abdomen just lateral to the cæcum.

The entire mass was very mobile, confirming the pre-operative clinical findings. Terminal ileum, cæcum and ascending colon were mobilized and resected. The stumps were closed and inverted and the terminal ileum was then anastomosed to the transverse colon side to side as a gun barrel anastomosis. A cigarette drain was placed through a stab wound into the right lower quadrant and the right rectus wound closed with a small rubber dam drain down to the fascia. A moderate amount of purulent drainage showed at the site of both drains. Temperature was normal, however, after five days and convalescence was smooth and progressive. A moderate diarrhoea showed from the fifth to the seventh days, but was controlled with tincture of opium. The patient left the hospital March 30, 1928, feeling stronger and better than prior to the operation and with his wounds fully healed. Six weeks after discharge from the hospital he had gained twenty-three pounds and since then has continued to add to his weight.

The pathological examination demonstrated the characteristics of adenocarcinoma.

DR. EDWARD R. CUNNIFFE related the details presented by a woman, seventy-one years of age, who was admitted to Fordham Hospital where a diagnosis of acute intestinal obstruction was made. At operation Doctor Cuniffe found an intussusception of the sigmoid which was easily reduced. The colon was very carefully palpated for a tumor, since a malignancy was suspected, but no evidence was found. The abdomen was closed and the patient did well. After an uneventful convalescence, she was discharged.

Two years later she returned to the hospital with a large mass in the sigmoid. At reoperation a carcinoma of the sigmoid, which also involved a loop of the small intestine, was discovered. The small intestine was resected.

ILEOCÆCAL INTUSSUSCEPTION DUE TO CARCINOMA

Then the entire mass, including the growth in the small intestine, was brought through the abdomen—a first stage Mikulicz operation having been performed. Eventually this was successfully completed. Three years later, at the age of seventy-six, the patient died with a recurrence in the wound.

DR. WALTER A. SHERWOOD stated that in the August number, 1927, of *Surgical Clinics of North America* he had reported three cases of intussusception associated with and apparently caused by neoplasms in the neighborhood of the ileocæcal valve. One case, in an infant, proved to be a simple fibroma, the second a lymphosarcoma, and the third a carcinoma of the cæcum just distal to the ileocæcal valve.

These three experiences had impressed him with the importance of a careful search for new growths in all cases of intussusception involving the ileocæcal region.

DR. JOHN DOUGLAS said that the occurrence of intussusception in adults is recognized as usually being due to some form of tumor which is the apex of the intussusception. The only case of intussusception in an adult which he has ever operated upon was a case of sarcoma of the small intestine which he presented before this society in 1916. In that case there was sarcoma of the ileum and a constant effort of the intestine to intussuscept was visible. Visible peristalsis was present and the tumor went up and down out of the pelvis. It was quite easy to feel and then it would disappear, as in Doctor Santee's case. He saw one case of intussusception of the small intestine in an adult within the last two weeks at St. Luke's Hospital operated on by another surgeon in which there was no sign of a tumor in the intestine which could be given as the cause for the intussusception. Doctor Douglas said he had found there was nothing more difficult to deal with than the necessity of giving a general anæsthetic in a case of acute intestinal obstruction. Most of them must be done under local or spinal anæsthesia and in some of these cases in the face of a great deal of distention, where a long operation is going to be necessary, and spinal anæsthesia will not last, it becomes necessary to give a general anæsthesia with the danger of vomiting in the presence of acute obstruction. He recently met with this problem. The man had an acute obstruction, due to a strangulated hernia, which had been present for several days. He had fæcal vomiting and his stomach filled rapidly. He felt he had to give this man a general anæsthetic. It then occurred to him to use a Levine tube, which was put through the nostril and emptied the stomach before the operation. He left the Levine tube in this man's stomach during anæsthesia and the patient continued to drain a considerable amount of fæcal vomitus throughout the operation. The tube was left in for twenty-four hours after operation and the patient did not vomit. Doctor Douglas would like to recommend this method.

DOCTOR PARSONS said that he had shown two cases, one before this society, and one before the Academy, of intussusception caused by benign intestinal tumors. One woman had ileocæcal intussusception due to a large lipoma. She was so fat that palpation of any mass intra-abdominally would

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have been a physical impossibility. In the other woman, in the early fifties, it was due to a fibroma arising from the antimesenteric border near the middle of the ileum. There was so much distention no mass was palpable. In Doctor Santee's cases the masses were palpable. This is explainable by the fact that a certain amount of gas was passed so that the tumor was not marked by distended coils of the intestine.

PNEUMOCOCCUS SUBCUTANEOUS ABSCESES

DR. HAROLD E. SANTEE said that pneumococcus subcutaneous abscesses are apparently rare. Report of them in the literature is unusual. Their rarity, however, is probably more apparent than real and they would probably be found more frequently were sufficient bacteriological investigation made. Personally he never saw one until two years ago.

The patient had been through a severe pulmonary pneumococcus infection of Type I and had received numerous camphor in oil injections. At the site of such injections in deltoid and thigh regions five abscesses developed successively; subcutaneously in four, beneath the fascia lata in one. These developed between the tenth and eighteenth days following the onset of his pulmonary infection; and approximately three weeks after the onset of this same infection, the patient was operated on for an empyema of the right chest which also showed a Type I pneumococcus. He made an excellent recovery.

No similar cases were encountered by him until last winter, when three additional patients were seen with pneumococcus abscesses.

On February 11, 1928, L. S., thirteen years of age, was seen at his home. He had just been brought home from his school where a large number of students had been taken ill with sore throats, tracheitis, bronchitis and some pneumonias. His illness began without particular cough or respiratory irritation, but with malaise, gradually increasing temperature, and soreness in the right pectoral region, near the axilla. On arriving home he was acutely ill with a temperature ranging from 101° to 103° , pulse 110, respirations normal. There was slight cough, but no pulmonary signs could be made out by the attending pediatrician. His physical examination was negative except for the right pectoral and axillary region. Here there was an obvious swelling involving the outer pectoral region for a distance of about three inches with tenderness, a slight feeling of boggiess and an accompanying acute adenitis of the chain of glands underneath the edge of the pectoralis major, extending upward into the axilla. He was watched for two days with warm wet dressings on this region and then incised. An abscess pocket which fanned out from the anterior axilla in a thin layer in front of the pectoralis major, underneath the pectoralis major and upward into anterior axillary region was drained. The glands were swollen, juicy and cedematous, well matted together in the lower axilla, but not broken down apparently. The pus was thick, creamy and without odor. Culture showed a streptococcus mucosus capsulatus or pneumococcus Type III. Convalescence was uneventful. No history of local trauma could ever be elicited in this case which was probably of respiratory tract origin.

Case three was that of a woman, thirty-nine years of age, who was admitted to the Second Medical Division at Bellevue Hospital February 13, 1928. Five weeks previously she was at full term when she became acutely

CHRONIC CYSTIC MASTITIS

ill with a chill, fever, cough and pain in the right chest. Her sixth child was born the following day. Following this rusty sputum and high fever continued for ten days, then she was better, but not well. She was admitted to the hospital because of delayed resolution of a right lower lobe pneumonia. One week after admission, or six weeks after the onset of her pneumonia, she showed a painful, tender swelling over the left rectus, just below the costal margin. This rapidly showed fluctuation. To exclude possible communication with her disease of the right lower chest, some pus was aspirated and a lipiodol injection made into the abscess. An X-ray taken showed complete localization with no communication into the thoracic cavity. Culture showed a pure pneumococcus Type I. Incision and drainage showed a well walled-off abscess in the subcutaneous tissues. No history of trauma either spontaneous or manual during delivery of her baby seems to account for the localization in this case.

The fourth case was in a man, forty-five years of age, who was admitted to Bellevue Hospital, February 28, 1928. He ran a typical left lobar pneumonia showing a Type I pneumococcus. From his history the onset of his illness dated six days before admission. Three days before admission he noticed a painful swelling in the region of the first metatarsophalangeal joint on the dorsum of the right foot. During his pneumonia this area on the right foot gradually extended and showed fluctuation. This was twice aspirated and showed a Type I pneumococcus. At the subsidence of the pneumonia, but when patient was still very ill, this abscess of the dorsum of the foot was incised and drained under spinal anaesthesia. The abscess was subcutaneous, but considerable cellulitic reaction surrounded it. No communication with surrounding structures was made out. This patient, like the first patient, developed an empyema. Thoracotomy and rib resection were done and he was discharged from the hospital on April 17, 1928, with his foot completely healed and his chest practically healed.

CHRONIC CYSTIC MASTITIS. EXPERIMENTAL PRODUCTION

DR. OTTO PICKHARDT read a paper with the above title.

DR. DEWITT STETTEN reported his personal experience with chronic cystic mastitis, of which he has seen a considerable number of cases, largely among private patients whom he has been able to follow closely. As yet he has seen no case treated primarily for a chronic cystic mastitis which has become carcinomatous. In the past ten years he has seen over fifty cases, most of which have been treated by conservative measures, namely, the excision of the cystic mass, and he recalls only two cases in which a simple mastectomy was done. In those cases in which the cyst alone was excised the microscopic examination of the surrounding breast tissue invariably showed further chronic cystic mastitis. A number of the cases showed recurrences of the disease, requiring in many instances two or more operations, but microscopic findings never showed malignancy. It is quite true that in almost all cases of carcinoma, chronic cystic mastitis will also be found, but this is readily accounted for by the fact that the ages at which the two diseases are prevalent is about the same.

DR. WILLIAM B. PARSONS reported two cases of the group when the diagnosis between chronic cystic mastitis and a carcinoma is doubtful. In both these cases frozen section was done at the time of operation and the diagnosis

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of cystic mastitis was made and simple mastectomy was therefore done. These cases were operated upon between two and three years ago and in both cases there has been a recurrence of swelling, or rather a hard swelling has appeared in the axilla. Operation was urged in both cases, but both refused. One has been lost track of. Recently the other returned with an ulcerating mass in the axilla. A specimen showed adenocarcinoma. At the original operation in both cases there was perforation of the duct epithelium, but no invasion was found at any point.

DR. JAMES N. WORCESTER said that some time ago he had sectioned a large number of breasts at Bellevue Hospital which had definite carcinoma and that practically all of these showed an accompanying chronic cystic mastitis, and in the areas of chronic cystic mastitis were sections which were very suspicious of early carcinoma.

These two lesions he thought have an intimate association.

STATED MEETING HELD JANUARY 9, 1929

The President, DR. FRANK S. MATHEWS, in the Chair

LARGE GASTRIC ULCER, SUBTOTAL GASTRECTOMY

DR. RICHARD LEWISOHN presented a man, sixty years of age, who was admitted to Mount Sinai Hospital November 26, 1926, with the following history: While lifting a heavy weight about two weeks before, he noticed a pain in the left groin. He consulted a physician who told him that he had an inguinal hernia and advised operation.

A careful study of this patient, however, after his admission to the hospital revealed that he had been suffering for the past year from epigastric pains which occurred about two hours after meals, also sour eructations. He never vomited. The pain was not relieved by bicarbonate of soda.

X-ray examination showed a large perforating ulcer of the lesser curvature, extending on to the posterior wall in the region of the reëtrant angle. An incisure was seen on the greater curvature opposite this perforation. There was no delay in gastric motility. *Diagnosis.*—Gastric ulcer.

An Ewald test meal showed free hydrochloric acid 13; total acidity 38. December 24, 1926, he was subjected to a subtotal gastrectomy with Murphy-button anastomosis. The operation was done under local anæsthesia through a five-inch mid-line incision in the epigastrium. Exploration revealed a large ulcer high up on the lesser curvature, about two inches below the cardia. This ulcer passed from the anterior wall to the posterior wall of the stomach, straddling the lesser curvature, the larger part of the ulcer occupying the posterior wall. The ulcer was about five centimetres in diameter; its edges were markedly thickened and indurated. The ulcer was densely adherent to the pancreas. There was marked œdema and hypertrophy of the gastric wall, especially in the region of the ulcer. (Fig. 1.)

On account of the high location of the ulcer and the marked inflammatory reaction in the surrounding tissues, the subtotal gastrectomy was performed in retrograde fashion. The right gastric-epiploic artery and the pyloric artery were divided and the stomach cut through just beyond the pylorus. The opening in the duodenum was closed in three layers. The gastrocolic ligament was then divided between clamps, the adhesions between the ulcer and the pancreas were separated by sharp dissection, the gastric artery was caught and the stomach was divided about one inch from the cardia. No gastric

LARGE GASTRIC ULCER, SUBTOTAL GASTRECTOMY

clamps could be applied on account of the high location of the ulcer. The opening in the stomach was closed in three layers after the female part of a Murphy button had been pressed into the lumen of the stomach. A loop of jejunum was then brought up through an opening in the mesocolon, the male part of the Murphy button was introduced and both halves of the button were united after a small stab wound had been made into the posterior wall of the stomach in order to be able to push through the gastric half of the button. The abdomen was closed without drainage. *Microscopic diagnosis.*—Gastric ulcer.

The patient had a rather stormy post-operative course during the first four days after the operation. He vomited a considerable amount of blood, requiring aspiration of the stomach and lavage at frequent intervals. From the sixth day on he made a very smooth and uneventful recovery. Rehfuess test meal, taken on the day of his discharge (January 7, 1927), showed free hydrochloric acid 0; total acidity 20. He has been in perfect health ever since his operation and has gained forty pounds.

DOCTOR LEWISOHN stated that he had seen a considerable number of patients admitted to the hospital with the complaint of an inguinal hernia and referred to the service for operation of this condition, in whom a careful study had revealed that they were suffering from a more serious trouble; namely, gastric or duodenal ulcer. While epigastric distress may be associated with hernia, every patient complaining of abdominal symptoms should get a careful gastro-intestinal study, as the symptoms of gastric distress in the majority of these cases are not due to the hernia, but to an intragastric lesion which requires surgical operative intervention in order to cure the patient.



FIG. 1.—Large gastric ulcer.

SMALL GASTRIC ULCER, PARTIAL GASTRECTOMY

DOCTOR LEWISOHN presented a man, thirty-five years of age, who was admitted to Mount Sinai Hospital November 11, 1925. He had complained of epigastric pain for the previous four weeks. The pain was not alleviated

by bicarbonate of soda. He had vomited a few times during the past three weeks and had frequent eructations and belching. No hematemesis.

The patient had had an attack like the one just described about three years previously. He had been suffering from epigastric distress more or less continuously during the last two years. Test meal showed a free hydrochloric acid of 55; total acidity, 66.

X-ray examination showed a very small projection at the region of the reentrant angle. The projection is only three-eighths inch long. There was no residue in the stomach after six hours. This patient had been gastroscoped previous to his admission by a laryngologist. The gastroscopy showed a chronic gastritis and failed to reveal the ulcer.

Operation, November 21, 1925, under local anesthesia of the abdominal wall. A very small penetrating ulcer with slight induration was found just at the reentrant angle. A typical partial gastrectomy was performed with Hofmeister anastomosis. The specimen showed a very small gastric ulcer, the crater being the size of a pin head, with some induration around this tiny ulcer. (Fig. 2.) The patient made an uneventful recovery and left the hos-

pital December 9, 1925. Ewald test meal on discharge was free hydrochloric acid 0; total acidity, 19.



FIG. 2.—Distal half of stomach, showing small gastric ulcer (a).

pital December 9, 1925. Ewald test meal on discharge was free hydrochloric acid 0; total acidity, 19.

DOCTOR LEWISOHN stated that he had presented these cases in order to show that both large and small gastric ulcers should be subjected to resection whenever feasible. While it might have been technically easy to excise the small ulcer as presented in the second patient, experience had shown that local excision with or without gastro-enterostomy failed to give the excellent results following partial or subtotal gastrectomy for gastric ulcer.

DUODENAL ULCER WITH MARKED PYLORIC OBSTRUCTION

DOCTOR LEWISOHN presented a man, thirty-three years of age, who was admitted to Mount Sinai Hospital October 16, 1928, upon whom he had first operated eight years previously at Beth Israel Hospital. At that time he had presented all the typical symptoms of a duodenal ulcer. However, the operation failed to reveal an ulcer in the duodenum. An appendectomy was performed and the abdomen was closed in layers.

Ever since his discharge from Beth Israel Hospital the patient had been suffering gastric distress at intervals of two to three months. During the last month his symptoms had become markedly aggravated. Constipation was very marked. He had lost fifteen pounds in the past three weeks.

A gastric lavage shortly after his admission showed that the stomach contained three quarts of fluid.

X-ray examination showed an extreme dilatation of the stomach. The

DUODENAL ULCER WITH MARKED PYLORIC OBSTRUCTION

stomach descends about three inches below the crest of the ileum with the patient standing. No barium was seen to pass through the pylorus during the entire fluoroscopic observation. At the end of twenty-four hours there was still evidence of complete retention. Nothing was seen in the small or large intestine. (Fig. 3.) These findings show a complete pyloric obstruction, the exact nature of which cannot be obtained from the Röntgen examination, but is usually due to an ulcer.

Experience has shown that it is not wise to subject patients with practically complete pyloric obstruction to an immediate operation. Operative interference was therefore postponed in this case for about a week, during which time he was subjected to lavages of the stomach which were given twice daily, subcutaneous injections of saline solution and the introduction of fluid by the Murphy drip into the rectum. The repeated gastric lavages establish a better tone of the gastric musculature and induce a marked reduction in the size of the stomach.

The two-stage operation as suggested by Crile and Lilienthal should be used only in cases of extreme weakness and emaciation, as it has been our experience that partial or subtotal gastrectomy following a previous gastroenterostomy is, as a rule, a much more difficult operation than primary resection of the stomach.

The operation was performed October 25, 1928, under spinal anaesthesia supported by gas, oxygen and ether toward the end of the operation. Mid-line incision between the ensiform process and the umbilicus. The stomach was markedly enlarged and a hard, indurated ulcer was found beyond the pylorus at the posterior wall of the stomach adherent to the pancreas. A typical partial gastrectomy was performed with a Hofmeister anastomosis between the cut end of the stomach and the jejunum. The specimen showed an active ulcer on the posterior wall of the duodenum, the size of the nail of the fifth finger and a diverticulum just beyond the pylorus. There was active infection in this ulcer, the base being of a greenish color. The pylorus was markedly contracted. (Fig. 4.) The patient made an uneventful recovery and left the hospital November 13, 1928.

When seen a few days ago he was in excellent health and had gained



FIG. 3.—Duodenal ulcer with obstruction, showing complete retention of barium test-meal in the stomach after twenty-four hours.

twenty-five pounds since the operation. The Rehfuess test meal showed free acid 0; total acidity 20 during the first hour; after two and one-quarter hours' observation free hydrochloric acid was registered as 32, combined acids as 48.

DOCTOR LEWISOHN stated that he presented this case in order to show that primary resection of ulcers is feasible in the presence of marked obstruction. It has often been stated that pyloric obstruction, especially when dealing with a healed ulcer, requires nothing else but gastro-enterostomy in order to effect a perfect and permanent cure. However, it is very often impossible to decide by palpation whether an ulcer has undergone complete healing and has formed a permanent scar, or whether it is still in an active state of infection. This patient, though he had been suffering from an ulcer for over eight

years, still had an active ulcer which caused the obstructive symptoms. At the time of the previous operation this ulcer had probably undergone temporary healing and thus the palpating finger failed to find any evidence of the ulcerative process.

ENDOMETRIOMA IN RECTOVAGINAL SEPTUM

DR. EDWIN BEER presented a woman, thirty-nine years of age, who was referred to him by Dr. J. Walter, who had recognized a fibroid of the uterus in September, 1920. Hysterectomy was done supravaginally May 15, 1922. The uterus contained both large and small fibroids which, on the right side, had grown into the floor of the pelvis and the broad ligaments. The left ovary was not removed. The appendix was removed at this operation.



FIG. 4.—Specimen showing a duodenal ulcer (a) on the posterior wall and a diverticulum (b) just beyond the pylorus (c).

The patient made an uneventful recovery and remained perfectly well until July 14, 1928, when she noticed some bleeding on two occasions. On examination, with the patient in the knee-chest position, through a cylindrical speculum, a polypoid, red mass about the size of a small raspberry was seen projecting from the normal mucous membrane into the posterior cul-de-sac. From this several specimens were excised. Vaginal digital examination showed

ENDOMETRIOMA IN RECTOVAGINAL SEPTUM

a mass between the vagina and rectum about as large as a walnut, and by rectum this could be felt directly under the mucous membrane.

The specimen excised showed, under the microscope, "typical endometrial glandular tissue". The patient was given a series of X-ray exposures with the object of producing castration of the left ovary which was still *in situ*, and indirectly controlling the endometriomatous bleeding.

Under this treatment, which was given in August, the mass, as felt by vaginal and rectal examinations, has diminished considerably; there has been no more bleeding; and on vaginal examination, through the endoscope one can still see a tiny red spot in the posterior fornix, which was coagulated with the high frequency current a little over a month ago.

In looking over the literature of this interesting condition, to which Sampson has contributed so much important knowledge, Doctor Beer said that Rulle mentions 1300 cases collected in the literature. The endometriomata were found either in the musculature of the uterus, in the fallopian tubes, in the adjacent peritoneum, in the broad ligaments, in the round ligaments, in the ovaries, in the rectovaginal septum, in the vesicovaginal septum, in the navel, in inguinal hernia, in the omentum and other parts of the peritoneum, in the vagina, in the rectum, or in laparotomy incisions after Caesarian sections.

The causation apparently is not absolutely clear. According to Sampson, a piece of the mucous membrane of the uterus wanders through the tubes and in this way produces, by its growth, an endometrioma. On the other hand, others believe an embryonic rest or metaplastic cells explain the origin of these curious masses. Halban holds the view that the glands extend through the uterine musculature to the peritoneum and then through the lymphatics, and are spread in this way. Most writers seem to favor Sampson's interpretation.

Endometriomatous tumors situated in the rectovaginal septum have often been operated upon, and at times have been found irremovable. If the nature of the tumor can be proven, as in the case presented, castration, with or without radium implantation into the tumor mass through the vagina, may be the most satisfactory non-operative method of treatment.

SPLENECTOMY FOR THROMBOCYTOPENIC PURPURA COMPLICATED BY MULTIPLE ENDOCRINE DISTURBANCES

DR. EDWIN BEER presented a woman, forty-eight years of age, who has always suffered from thyroid deficiency and has lived on thyroid extract. This condition seems to be familial, several members of the family being in the same condition. Past history of no significance.

In June, 1928, she began to bleed from various mucous membranes (gums and gastro-intestinal tract) with progressive anæmia. The anæmia was combated with repeated transfusions. Previous to the last transfusion, the hæmoglobin was down to 31 per cent. No toxic causes for the purpura could be found, and blood examination by Dr. N. Rosenthal showed typical changes of thrombocytopenic purpura.

When first seen by Doctor Beer, August 13, 1928, she was profoundly anæmic, with skin thickening, suggesting low-grade myxœdema; and the mucous membrane of the mouth and gums as well as the subcutaneous tissues of the skin of the body were discolored with small and larger hæmorrhages.

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Abdominal examination negative. Spleen could not be felt definitely on account of the size of the patient. Although she had been taking about six grains of thyroid daily at different periods during six to seven years, there seemed to be no relation between this medication and the purpura. Bleeding began in June, 1928, but patient claims that she had been weak, feeling poorly for about six months prior to that.

Before operation, patient was given a transfusion of blood. August 14, 1928, a subcostal incision was made and a spleen of normal size was easily removed. As far as the wound was concerned, the patient made an uneventful recovery. She stood the operation very well and received another transfusion after the operation was over.

During the day following operation, her temperature was around 103° ; she vomited, bringing up some blood clots, and bled a little from the gums. She looked sick and the extremities were icy cold and clammy. Urinary output was two ounces. Blood urea was 41.

In the second twenty-four hours after operation, blood examination showed an increase in haemoglobin up to 53 per cent. Clot retraction was present and bleeding time had dropped from thirty minutes to three minutes. On this second day it was noted that her pulse was less regular and feebler. Vomiting had ceased and patient began to take fluids by mouth and held her rectal drip of glucose. The urinary output rose to six ounces and contained granular casts. Mental apathy profound; and hypoglycæmia 51.

On the third day patient gave signs of consolidation (broncho-pneumonia, pneumococcus type No. 2) in the left lower lobe. Temperature rose to 105.2° . Patient became stuporous with face twitchings; pulse though of good quality and force was accelerated to the rate of 120. Under further diuretics, oliguria gradually disappeared, but the patient's vasomotor disturbances in the extremities, as evidenced by the icy, clammy skin, persisted. The remarkable contrast between the satisfactory cardiac condition and the patient's stupor and the vasomotor depression, suggested some doubt as to a fatal termination. The patient was transfused again and a marked improvement developed during the next twenty-four hours.

On the fourth day after operation patient suddenly developed carpopedal spasms. By this time temperature had gradually come down; diuresis was satisfactory and the extremities were much warmer. Under calcium medication the carpopedal spasms disappeared, and with the disappearance of these the mental condition became much clearer though now, instead of being stuporous, the patient was irrational and excessively talkative.

About eight days after operation the symptoms of irrationality disappeared, and the mentality became clouded, patient very dull, and thickening of subcutaneous tissues more marked, suggesting an acute myxœdema. Under thyroid administration these symptoms cleared up, and by the eighth day after operation she continued to an uninterrupted recovery. Following operation there were a few small hæmorrhages from the gums and perhaps also from the stomach. Under the adhesive used for dressings, patient developed miliary petechiæ which rapidly disappeared. The patient has remained well since.

The pathological report on the spleen by Dr. P. Klemperer showed: "Hyperplasia of lymphoid cells in follicles and throughout the pulp with the appearance of extramedullary hematopoieses. The picture is suggestive of a leukæmic process."

SARCOMA OF THE LIVER, EXCISION

DR. EDWIN BEER presented a man, thirty-eight years of age, who was admitted to Bellevue Hospital October 24, 1928, with the history that nineteen

SARCOMA OF THE LIVER, EXCISION

years ago he had been operated upon in Massachusetts for what was probably a pyloric or duodenal ulcer with massive exudate about the ulcer simulating malignancy. At this time, judging from the present X-ray findings, a gastro-enterostomy had been done.

Following the above operation he had been well until about one and one-half years ago, when he began to have pain and signs of weakness in the right side of his body; also some pain in shoulder, hip and knee-joint. He thinks that occasionally he has been jaundiced, but has not lost any weight. During recent years he has had twenty-four salvarsan injections which possibly may account for some of the jaundice, which he thinks he noted.

His general health was not materially interfered with. He has had no urinary symptoms and no gastro-intestinal symptoms. His chief complaint on admission was pain across the lumbar spine, particularly in the right lumbar region.

Physical examination was completely negative except for a large mass in the right half of the abdomen which ballotted readily with the kidney. On deep inspiration the whole mass descended with the kidney and could not be held down as the diaphragm ascended. The edge of the liver could not be felt. There was no tenderness over the mass and no rigidity. The urine was negative.

An X-ray taken of the gastro-intestinal tract showed a normal gastro-enterostomy stoma, but the duodenum was not visualized. A van den Bergh test of his serum showed indirect positive, but direct was negative.

Under the impression that they might be dealing with a right kidney neoplasm, a pyelogram of the right kidney was made and the pelvis was found slightly dilated with normal calices. In this pyelogram the kidney outline was sharp, and the upper pole reached to the transverse oblique line represented by the lower edge of the liver (posterior lobe). This X-ray finding, showing the liver margin, suggested the diagnosis of a tumor arising from the capsule (either the fatty or true capsule) of the right kidney and reaching forward into the abdomen.

With this probability in mind, the patient was explored November 5, 1928, through a right lumbar incision which was extended forward so as to open the peritoneum widely. The kidney was exposed and found to be normal and in no wise involved. The peritoneum in front of the kidney was opened and on inspecting the inferior surface of the right lobe of the liver directly in front of the kidney, a tumor the size of an orange was seen which was whitish blue in color, covered with dilated veins. At first it simulated a gall-bladder, but the gall-bladder was found lying median to this tumor. The mass was tense, definitely cystic and projected about two inches above the adjacent liver surface. On drawing the elongated right lobe out of the wound, on the posterior lobe high up, a small subcortical area of discolorization was disclosed which suggested the appearance of a gumma, but probably was a secondary deposit similar to the large tumor. Unfortunately, aspirations of this mass sent to the laboratory proved to be of very little value for diagnostic purposes. Overlying the kidney on the peritoneal surface there were three or four flat, yellow plaques which were very suggestive of neoplastic deposits. Through this lateral incision, the partly cystic tumor was enucleated without encountering any severe bleeding until the lobe of the liver was entered. Where the liver was drawn out thin over the tumor there was scarcely any oozing, but where the mass was attached within the right lobe of the liver, there was rather copious venous oozing which could not be controlled with packing. In closing over this defect, chromic gut sutures of the Lembert type were used, folding under the edges of the liver which had been thinned out over the

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tumor mass. By using this type of stitch, not only was the bleeding controlled satisfactorily but the large cavity in the right lobe of the liver was readily obliterated. Wound closed without drainage. The patient made an uneventful recovery.

The pathological report on the specimen was sarcoma, and the microscopic report was spindle-celled sarcoma. (Doctor Symmers.)

Microscope shows presence of a new growth composed of rather short spindle-shaped connective-tissue cells and an abundance of smooth, pinkish staining intercellular substances.

In places these cells are arranged diffusely—in other places, they tend to arrange themselves in whorl-like formation. The nuclei are all of the mature variety and only moderately rich in chromatin. The mitotic figures are conspicuous by their absence. Scattered through the tumor at irregular intervals are noteworthy numbers of slit-like or cavernous spaces, some of which are occupied by red blood corpuscles.

If one may judge of the malignancy of this tumor by its histological characteristics, I should be inclined of the opinion that it is a spindle-cell sarcoma of no very extreme malignancy.

The patient was discharged from the hospital November 19, 1928, feeling perfectly well without our being able to locate any primary neoplasm.

On January 1, 1929, patient was re-admitted as he was complaining of some pain across his back. The only new symptom that he had developed was a melæna, which may be accidental and may be of some significance. Complete X-ray studies of colon, and all long bones, head and spine show no other focus. C. Garrk (1923) reports that probably twelve cases of sarcoma of the liver have been operated on. They are more frequent in childhood than carcinoma of the liver. Secondary sarcoma is sixty times as frequent as primary late secondary tumors. Liver may give symptoms thirty years after the primary disease has been eradicated.

PYELOLITHOTOMY; PYELOPLASTY; REIMPLANTATION OF THE OBSTRUCTED URETER IN NEW KIDNEY PELVIS

DR. EDWIN BEER presented a man, thirty-eight years of age, who was admitted to Mount Sinai Hospital April 27, 1928, complaining of attacks of pain in the right kidney region for twenty-one months. More recently, during the last five months, he had similar attacks on the left side. All the more recent attacks were in the left kidney; they were very severe, associated with chills, temperature, vomiting, dysuria and hematuria.

X-ray examination showed large stones in the left kidney running into the calices; and smaller but less extensive calculi in the right kidney.

Cystoscopy showed good indigocarmine excretion on both sides; pus in both kidney specimens; urea on the right side 1.2 per cent., and on the left side 0.8 per cent.

In view of the fact that the chances of saving the left kidney by doing a conservative operation seemed problematic, it was decided to operate upon the right kidney in which the stones seemed to be placed more favorably for a conservative procedure. Having reestablished fairly normal conditions in the right side, subsequently the left kidney could be dealt with as indicated by the pathological findings.

May 15, 1928, the right kidney was exposed and found hydronephrotic. The pelvis was as large as a peach and suddenly narrowed down at the ureteropelvic junction where it hung over a large accessory blood vessel crossing behind the ureteropelvic junction. The pelvis was opened posteriorly and eight fair-sized facettted stones were removed. X-ray control on the operating

OBSTRUCTED URETER IN NEW KIDNEY PELVIS

table showed the kidney contained no more stones. Attempts to pass the ureteropelvic junction with a probe from above down, as well as through a small ureterotomy incision from below up, failed, probably owing to the traction on the kidney which displaced the normal relations, in part perhaps due to an ulceration which was found at the ureteropelvic junction on splitting the pelvis wide open. During these manipulations, the dilated pelvis, having been drawn through in front of the kidney where it could be more readily handled, the ureter tore at the ureteropelvic junction. The ureter, about one inch below the point of tearing, was healthy in appearance and was drawn up and attached through a stab-wound in the posterior surface of the pelvis. The ureter was attached with two stitches on the inside of the pelvis (plain cat-gut), and two stitches on the outside of chromic gut. To splint the anastomosis, a ureter catheter was led down through the small ureterotomy incision which had been made to probe upward through the ureteropelvic junction at the beginning of the operation. This catheter was then led through the posterior pelvic wall alongside the reimplanted ureter running parallel to it and out through a small incision in the anterior pelvic wall. The pelvis was sutured by infolding so as to make a small pelvis, funnel-shaped, with the ureter coming out at its dependent part.

About six days after this operation, the splint catheter was removed and the wound healed rapidly.

June 24, 1928, the patient was cystoscoped to determine the function of the reimplanted ureter, and it was found that the catheter ascended twenty-four centimetres on this side and that the indigocarmine output was fair. On the left side the catheter ascended further and the indigocarmine was strong. Also the calibre of the stream on the right side was smaller than on the left. Urea concentration on the right side was .1 per cent. and on the left .6 per cent. On the right side there were a few pus cells, and on the left a few granular casts.

The man was discharged from the hospital June 5, 1928, with instructions to report subsequently for treatment of the stone in his left kidney.

Four days after discharge he had a severe colic on left side with a temperature of 104° .

On re-admission he was cystoscoped and the right catheter ascended twenty-four centimetres, and coming from this side the urine was brilliant and clear and contained strong indigocarmine; microscopic examination showed a few pus cells and urea was 2.3 per cent. The left side showed an obstruction at twenty-four centimetres, and thick pus was washed out from the ureter at this level and then the catheter passed thirty-five centimetres; there was no secretion obtained through the catheter so the catheter was left *in situ* and the diagnosis of obstructed, infected, calculous pyonephrosis was made.

The patient apparently was definitely living on the previously operated right kidney.

With the indwelling catheter in the left kidney, secretion gradually came back, so that nine days after introduction of the indwelling catheter, phthalein output from the left kidney in four hours was 10 per cent., three ounces of urine being obtained; during the same time patient voided sixteen ounces of urine containing 35 per cent. phthalein.

DR. ABRAHAM HYMAN, to how important it is to be conservative in stone surgery, and to make every possible attempt to save the kidney, related the following case-history:

A young girl was brought to the hospital with a large stone in the right

kidney. An X-ray examination showed no calculi in the opposite kidney. Cystoscopy demonstrated markedly impaired function on the side of the stone; the other kidney was normal. Following pyelotomy, a sinus persisted in the lumbar region, through which all her urine was discharged. A post-operative cystoscopic examination demonstrated an obstruction at the ureteropelvic junction which could not be passed, and no urine was obtained from this kidney. A pyelogram verified this obstruction at the ureteropelvic junction.

After waiting at least six weeks, during which time all the urine from the right kidney discharged through the sinus, a secondary operation was decided upon. At this operation it was found that the upper end of the ureter had apparently sloughed away, and was sealed off. The kidney was embedded in a mass of dense, fibrous tissue. It was considered impractical to do a ureteropelvic anastomosis, and the kidney was accordingly removed. The patient returned about eight months after this second operation, during which time she had developed a large calculous in the left kidney. Her condition was rapidly growing worse. The blood chemistry mounted steadily, and before operative interference could be undertaken she died of uræmia.

LATERAL ANASTOMOSIS BETWEEN THE BRACHIAL ARTERY AND VEIN TO REDUCE BLOOD PRESSURE IN A PERFORATING ANEURYSM OF THE AORTA

DR. EDWIN BEER presented a specimen of lateral anastomosis between the brachial artery and vein, saying that some years ago Dr. Eli Moschowitz had suggested to him the possibility of controlling the high blood pressure in primary hypertension cases by making an arteriovenous aneurysm. According to the literature of arteriovenous aneurysm, the general blood pressure drops as a result of this abnormal communication; in turn the heart hypertrophies and eventually gives out. If patients with primary hypertension could have their lives prolonged by producing arteriovenous aneurysm, it might be a useful procedure. In thinking the matter over, in view of the disability produced by an arteriovenous aneurysm, he decided that the only feasible non-crippling site for such an anastomosis in a right-handed patient would be in the left brachial artery and vein.

At this time a man, fifty-two years of age, was admitted to Mount Sinai Hospital April 10, 1928, to the Medical Service of Dr. George Baehr, complaining of terrific pain over his left chest anteriorly where for two months a growing, pulsating mass was developing. Twenty years ago, patient had had a syphilitic infection for which he received treatment, but the Wassermann was still four plus.

Physical examination showed the mass in the left anterior aspect to be a large aortic, arch aneurysm which had eroded the ribs and part of the sternum and which projected beyond the level of the adjacent skin about five to six centimetres and was about ten centimetres in diameter.

The medical attendant suggested an anastomosis between the right common carotid and the right jugular vein, as had been carried out successfully by Wayne Babcock. After reading the report of this case, not being entirely convinced by the physiological discussion and the fear lest such a sudden upset in the circulation might be fatal, placing an undue strain on the

ANASTOMOSIS BETWEEN THE BRACHIAL ARTERY AND VEIN

right heart and pulmonary circuit, Doctor Beer determined to make use of what he had previously decided to try in a primary hypertension case, and carried out, under local anæsthesia, a lateral anastomosis between the left brachial artery and vein, making a stoma in the typical way about three-fourths inch in length.

Pre-operatively, the blood pressures were as follows: 140/80; 135/75; 140/90; 145/95. Immediately following operation, radial pulse was present and the diastolic pressure had dropped to 30. Pain in the chest within twenty-four hours was gone and the thumping sensation subsequently disappeared. The circulation in the left hand had not changed.

Repeated blood pressures after operations gave the following rating: 115/55; 106/58; 116/60; 104/50; 116/60; 118/62; 110/68. All these were taken within two weeks of the operation. Patient was out of bed during the second week. On auscultation of the site of the arterovenous aneurysm, there was a distinct bruit. The patient stated that he felt ever so much better, the subjective sensations of beating in the aneurysm having disappeared and his pain, which had been severe, had also definitely disappeared.

About three weeks after the operation, the arm suddenly began to swell down to the wrist, apparently due to either a phlebitis or a lymphangitis which disappeared after wet dressings.

Further blood pressures were as follows: 110/58; 125/60; 114/68. A comparison of these eleven blood pressures (post-operative), with the four pre-operative blood pressures shows a well-marked drop in both systolic and diastolic pressures, which was the object of the surgical procedure.

The patient was allowed to go home June 1, 1928, the operation having been done April 22, 1928. He was advised against doing anything rash.

He was out of the hospital ten days when he returned with multiple ulcerations of the skin over the aneurysm, which ruptured in the ward two days after admission with immediate fatality.

Before the aneurysm ruptured the blood pressures showed: 126/72; 118/68. The post-mortem examination showed luetic aortitis with perforation of aortic aneurysm. The anastomosis between the brachial vein and artery was patent and no evidence of any thrombosis. The intima at the site of anastomosis was slightly thickened. In addition to the main aneurysm in the aorta nearby there was a second aneurysmal dilatation.

SOME CLINICAL FINDINGS IN SUBTOTAL GASTRECTOMY

DR. CONSTANTINE J. MACGUIRE, JR., read a paper with the above title for which see page 658.

DR. HERMAN FISCHER felt that Doctor MacGuire did the proper and right thing in doing a partial gastrectomy in the case of a small gastric ulcer, especially because the patient was suffering in addition from a severe chronic gastritis. Some European surgeons have even gone so far as to advise resection of stomachs in patients who have been suffering from chronic gastritis and who could not be cured by medical means. Doctor Fischer considered this teaching very dangerous and going too far, but there was no doubt in his mind that it is not the *size* of the ulcer which should influence us in our decision for resection. After a good many disappointments with the results of gastro-enterostomies in gastric and duodenal ulcers he began to do a subtotal gastrectomy in all cases in which it was feasible. He thinks to call some

surgeons who do more resections than gastro-enterostomies "radicals" is a misnomer. Every surgeon who has had a large experience in stomach work will be radical when it is indicated and will be conservative when he knows that by radicalism he will do more harm than good. As to the question of duodenal ulcers, Doctor Fischer resects in some cases and in some he doesn't. In fact he said he never knew before the opening of the abdomen what he was going to do, and feels it is a bad plan to tie oneself down to any specific operative procedure before a thorough inspection of the existing pathological condition has been done. The late results after resection, as seen in our follow-up clinic, four or five years after operation, are much more gratifying than the late results after gastro-enterostomy. Almost invariably the resected patients have no complaints at all, they need not keep a special diet and they have forgotten entirely that they ever had a poor stomach.

If you interrogate the patients with gastro-enterostomies a large percentage of them will complain of more or less stomach distress and some will tell you that they are not benefited at all by the operation. Doctor Fischer's mortality rate is 8 per cent., or was several years ago. Doctor Fischer felt he had overlooked ulcers and is never satisfied with his examination unless he has opened the stomach. He opens the stomach, examines it and palpates the mucous membrane of the duodenum. He has used the cystoscope or, what is even better, the sigmoidoscope for direct ocular inspection of the duodenum, and in spite of this careful ocular and digital examination he has in one case overlooked the ulcer. Several months later the patient was operated upon by Doctor St. John and cured by resection. Sleeve resection for ulcer at the lesser curvature should not be done, Doctor Fischer thought, because in his opinion it is often followed by an hour-glass stomach. He had had no experience with ulcer excision and felt that resection is a better operation. The patients get well after resection in spite of their ulcer constitution, so-called. This constitution one cannot change and will have to put up with. It is better to have the ulcer out than have it perforated, or have it degenerate into carcinoma. Doctor Fischer has shown several cases here in which a jejunal ulcer had developed, among them were three of his own cases in which he was forced to do a gastro-enterostomy and he doesn't know how large a percentage of jejunal ulcers we have in our American hospitals. He therefore prefers subtotal resection in every case where the general condition of the patient will allow it.

DR. JOHN A. MCCREERY said that he had seen most of the cases operated on by Doctor MacGuire and had been impressed by their smooth post-operative course, in spite of the difficulties of the procedure in the secondary cases. The comparatively large number of the latter had led him to review the cases of duodenal ulcer on the First Surgical Division of Bellevue Hospital with the feeling that it might be possible to select certain types in which a primary resection was justifiable.

CLINICAL FINDINGS IN SUBTOTAL GASTRECTOMY

Somewhat to his surprise Doctor McCreery found that primary resection was being done in about 10 per cent. of these cases, usually in cases where hæmorrhage made destruction of the ulcer advisable, while the large size or position of the ulcer made this impossible by less extensive procedures. In the ordinary case, however, he felt that gastro-enterostomy or pyloroplasty with its 70 per cent. of satisfactory results, as shown by a careful follow-up, was still the advisable procedure.

His personal preference was for the posterior polya operation although he realized the advantages of the Balfour modification if further operation should be necessary. Provided the removal of the lesser curvature was adequate, the type of procedure made little difference.

DR. FORDYCE B. ST. JOHN said that the follow-up studies at the Presbyterian Hospital during the past twelve years have demonstrated the reasons for coming to the same conclusions to which Doctor MacGuire has come; *viz.*, that partial gastrectomy seems to be the operation of choice in recurrent and marginal ulcers.

DR. HENRY W. LOURIA (by invitation) said that from October, 1927, to February, 1928, he had the privilege of serving as a voluntary assistant on the gastric service of von Haberer at the University of Graz.

Von Haberer, who is a pupil of the school founded by Billroth and continued by von Eiselsberg, has been interested in the question of ulcer for the past twenty years. Dissatisfaction with the results of gastro-enterostomy in the treatment of ulcer, led him to try other procedures such as the sleeve resection of Riedel and Payr and pyloric occlusion as advocated by von Eiselsberg. The latter procedure was followed by an unusually high percentage of marginal ulcers.

For the past fifteen years von Haberer has been employing subtotal gastric resection almost exclusively for the treatment of ulcer, whether gastric or duodenal. He emphasizes the importance of resecting the lesser curvature of the stomach and the distal portion of the greater curvature, commencing at the point where the left gastro-epiploic artery pursues its course from left to right along the greater curvature. The amount of stomach removed depends upon the size of the stomach; but in every instance includes the entire lesser curvature.

One of the drawbacks of gastric surgery abroad is the absence of a systematic follow-up, as we understand it in this country. The patients are not routinely instructed to return to the clinic at specified dates, although the staff claim that they have a fairly good impression of their results. During his stay at Graz the speaker sent a follow-up letter to all patients who were operated on from January 1, 1925, to December 31, 1926. This series included 257 patients, of whom only 179 could be traced. Forty per cent. of the patients were examined in the clinic and the rest responded by letter. Eighty-five per cent. of the patients were completely symptom free. Ten per cent. complained of occasional gastric upset following overeating or the ingestion

of sweet foods, 5 per cent. were either unimproved or worse than before the operation. The total mortality following resection in this group of cases was 8.4 per cent.

The operation which von Haberer prefers is the Billroth No. 1 when technically feasible. The second choice is the terminal lateral modification of the Billroth No. 1, and his last choice the Billroth No. 2. Throughout Germany, Austria, Switzerland and Hungary, in the leading university clinics, extensive gastric resection was the method of choice for the treatment of gastric or duodenal ulcer. There are but few hospitals that still prefer gastro-enterostomy for the surgical treatment of gastroduodenal ulcer.

DR. EDWIN BEER called attention to the fact that the proper treatment of duodenal and gastric ulcers, especially the surgical treatment, is in a state of flux. The literature is so full of contradictory statements concerning the incidences of secondary ulcerations and the advisability of doing extensive gastric resections that the surgeon is liable to be in doubt as to just what he should do in any particular case.

Fischer and Lewisohn have mentioned the fact that gastrectomy (subtotal) is preferable to gastrojejunostomy which leads to secondary gastrojejunal ulcerations in a large proportion of patients (up to 33 per cent.) Other surgeons report an incidence of between 2 and 4 per cent. of these secondary ulcerations in duodenal ulcers.

It would seem that this contradiction might be straightened out by the pathologists who must be seeing numerous cases of duodenal ulcers in which a gastro-enterostomy has been done, and they could in some of the large pathological laboratories, as well as in the Societies of Pathology, gather together a suitable number of patients and thus establish the correct incidences of secondary gastrojejunal ulcerations following gastro-enterostomies for duodenal ulcers. Whether the variations in the technic of gastrojejunostomies lead to varying incidences of secondary ulceration, it is difficult to say. In Balfour's recent analysis of one hundred physicians on whom gastrojejunostomies have been performed for duodenal ulcers, the incidence of secondary ulceration surely was what is generally considered by most surgeons as the normal incidence of this complication—between 2 and 4 per cent.

He personally had operated upon some 150 duodenal and gastric ulcers—most of them duodenal—and though at the present he favors in duodenal ulcers the Finney pyloroplasty with excision of the ulcer, still in a large number of cases, he has done nothing but the no-loop right-to-left posterior retrocolic gastrojejunostomy, and, as far as I know, only one of these cases has developed a demonstrable secondary jejunal ulcer. The end-results reported by Finney and his colleagues on the pyloroplastic operation—which goes by his name—also compare very favorably with the above publication by Balfour, and it would seem that gastrectomy for duodenal ulcer is as yet too radical a procedure and not justified.

Another interesting contradiction that one encounters in the literature is

CLINICAL FINDINGS IN SUBTOTAL GASTRECTOMY

found in the fact that one group of "resectionists" claims that one must take away most of the stomach and produce an anacid condition to prevent secondary ulcers. Another group reports secondary ulcers in the face of anacidity.

Von Haberer, who does a Billroth No. 1 operation, naturally cannot remove as much of the stomach as those who do a Billroth No. 2; still, von Haberer is satisfied with his operative procedure and claims that recurrences do not develop. Furthermore, even subtotal gastric resections, which deprive the patient of so much stomach that he empties at once into his jejunum and is not aware that he has a stomach, does not apparently prevent secondary ulcerations.

As already mentioned, numerous cases of secondary ulcerations have been reported following subtotal gastrectomy, and Nystroem has collected from the literature sixty-one such cases to which Balfour has added some eighteen more. This is in contrast to the recognition of secondary ulcerations following gastro-enterostomies. Following gastro-enterostomies, one of the earliest reports of secondary jejunal ulcerations was made by M. von Cachovic, in 1904, who reported three cases of his own and collected nine more from the literature. This covered a period of about twenty years following the introduction of gastro-enterostomies. In the short period in which subtotal gastrectomies have been done, it is surprising that seventy-nine cases of secondary ulcerations have been reported even after making due allowance for the improved methods of diagnoses of this complication at the present time. Whether the "radical" surgeons are going to become less radical in the future remains to be seen. The possibility of these secondary ulcerations following subtotal gastrectomies has already led to advising an anticollic gastro-enterostomy so as to be more readily able to deal with secondary ulcerations (Ranzi). Furthermore, to relieve subtotal gastrectomy of any blame for the later gastro-jejunal ulcers, Spaeth has attributed these to ulcerations in misplaced islands of gastric mucosa.

The attitude of the speaker can be summed up as follows: In duodenal ulcers, wherever possible, excision of the ulcer with pyloroplasty, a wide duodeno-gastrostomy being made. Whenever impossible, a no-loop Mayo posterior right-to-left gastrojejunostomy with light clamps and using absorbable chromic catgut throughout. On the other hand, in ulcers of the stomach resection whenever possible, the Hofmeister technic being used. In those cases where resection cannot be performed, a no-loop gastrojejunostomy, or simple jejunostomy, should be done for the relief of pain and feeding purposes.

DR. RICHARD LEWISOHN stated that recurrences following resections of the stomach were often caused by incomplete operations. It is a well-known fact that pylorectomies do not reduce the gastric hyperacidity and are sometimes followed by recurrences. The term subtotal gastrectomy should, as the name implies, be reserved for cases in which the upper line of dissection is situated very near the cardia. Among the pictures shown by Doctor MacGuire two cases deserved this classification. The others were at best partial gastrectomies.

He agreed with Doctor Fischer that some ulcers cannot be removed without grave risk to the patient. About 95 per cent., however, of gastroduodenal ulcers can be resected without great technical difficulties. The speaker has used partial or subtotal gastrectomy as the method of choice during the last six years with a mortality of 5.5 per cent.

STATED MEETING HELD JANUARY 23, 1929

The President, DR. FRANK S. MATHEWS, in the Chair

TUBERCULOSIS OF DEEP TROCHANTERIC BURSA

DR. WALTER M. BRICKNER presented a lad, now nineteen years of age, who a year ago entered the Hospital for Joint Diseases with the diagnosis of chronic osteomyelitis of the great trochanter of the left femur. This diagnosis was based on pain referred especially to that area, localized tenderness, and the X-ray appearance. There was no fever above 99.5°. Flexion, extension and external rotation

of the left hip were limited, but apparently only by pain. The gait was correspondingly awkward. No swelling was noted on or in the neighborhood of the trochanter; but over its centre was a circumscribed area of what appeared to be bone tenderness. Röntgenograms of the hip showed only roughening and erosion of the cortex of the great trochanter. The pain was fairly continuous and severe.



FIG. 5.—Tuberculosis of the deep trochanteric bursa. Specimen partly filled with wax.

of 1924 when, a year or more after a fall on his left hip, he developed pain there. During the next three years he was for various periods in several hospitals in New York and vicinity.

At operation an incision was made from about seven centimetres below the crest of the ileum downward on the lateral surface of the buttock about twenty-five centimetres. The fascia over the trochanter was split, entering the deep trochanteric bursa, from which there escaped much thin, yellowish fluid. A fibrinous mass the size of a hen's egg was exposed and removed from the bursa. This bursa proved to be enormously enlarged, thickened and multilocular, extending upward and backward under and between the glutei, and downward under the thigh muscles, to all of which structures it was closely adherent. Without dividing any muscle bundles, and by dint of retracting and patient dissection, the entire complicated sac was enucleated *en bloc*, after emptying it of its fluid and fibrinous masses. It contained no rice bodies. A rubber dam drain was inserted and the fascia and skin were closed. The operation occupied two hours, and was followed by mild shock.

The patient's history, as later pieced together, dated back to the summer

MYCOTIC ULCERS OF THE LEG

There was profuse serous discharge for several days; and on the sixteenth day about an ounce of pus escaped from the centre of the wound. The patient left the hospital February 23, 1928, three weeks after the operation, without pain and walking well. The skin had healed with three sinuses which continued to discharge serum while the boy was again an out-patient. To effect closure of these he was sent on April 11, 1928, to the Country Home of the hospital, at Far Rockaway, Long Island, where he was treated with high caloric diet and heliotherapy, natural and artificial. When discharged from the County Home, in June, he had gained four pounds and his wound was healed. The scar has given no further trouble and the patient has continued to feel well.

Following is the report of Doctor Jaffe, the hospital pathologist: "The *gross specimen* (Fig. 5) is a very large bursa, measuring at least fourteen centimetres in length. It consists of one large cavity and one smaller cavity that communicates with the larger one, and measures about four centimetres in length. Across, the bursa is about twelve centimetres in largest diameter. It measures up to about three millimetres in thickness. The bursa contains a whitish, coagulated fibrinous material. The wall is somewhat granular. *Microscopical section* of the material that filled the bursa shows an acellular fibrinous mass. Several sections from the bursal wall show it to be lined by a tuberculous granulation tissue. Scattered through the wall is an occasional well-formed tubercle with giant cells. *Culture* of the fluid removed at operation is sterile, and smears show no bacteria. *Diagnosis*.—Tuberculous bursitis."

DOCTOR BRICKNER said he had seen only two other instances of tuberculosis of a trochanteric bursa, many years ago. Both of these bursæ were small and easily removed.

MYCOTIC ULCERS OF THE LEG AND PYARTHROSIS OF THE KNEE

DR. WALTER M. BRICKNER presented a woman, thirty-six years of age, who was admitted to his service at the Hospital for Joint Diseases October 1, 1927, for the treatment of acute pyarthrosis of the left knee. She was about two and one-half months pregnant, had borne two children, and had been operated on for a right ureter calculus. Nine days before admission she felt pain in the left knee and noticed a "boil" on the middle of the anterior aspect of the left leg. This grew larger and at the same time the knee became swollen and more painful. Two "boils" soon appeared just below the first one, one on each side of the leg.

On admission there was noted a circumscribed cutaneous infection over the midshin, somewhat furuncular in type, and what looked like a discharging furuncle on each side of the leg, just below this lesion. The left knee was distended with fluid, hot, painful (especially on attempted flexion) and tender on its lateral aspect where the skin was slightly reddened. The temperature was 103°, the pulse 120. The urine was free of sugar (and remained so throughout). The initial blood count showed 10,100 leucocytes; 70 per cent. neutrophils; 26 per cent. small lymphocytes; 4 per cent. large lymphocytes.

DOCTOR BRICKNER said he obviously had to deal with a pyarthrosis, but subacute rather than fulminating. He emptied the joint immediately, by needle puncture, evacuating fifty cubic centimetres of thin, cloudy, yellowish fluid. Five-pound traction was attached to the leg to separate the joint surfaces; and a wet dressing was applied to the skin lesions. The fluid from the joint contained pus cells in abundance, but no bacteria were seen in it, and cultures remained sterile.

The next morning the joint, having become again distended, was emptied a second time and, between two needles, was washed out thoroughly with 1000

cubic centimetres of Dakin's solution. There was no refilling after this lavage of the knee. In the thin purulent fluid removed on this occasion no bacteria were found, and cultures remained sterile. Blood cultures also showed no growth. The next day the patient could flex and extend her knee without

pain. There were, however, an area of discoloration near the joint on the medial aspect of the thigh, and pronounced swelling from just below the knee to the groin. The temperature was 102° ; there was no crepitation or redness. This swelling disappeared gradually in about two weeks, by which time the patient could flex her knee 90° without effort. After the seventh day the temperature was never above 100° .

By the tenth day the lesion on the front of the leg had grown much larger. It is now a circular red ulcer, with small scattered areas of deeper suppuration. The smaller lesions below it look similar. The larger lesion at that time was of the size and appearance shown in the photograph (Fig. 6), on which the arrows indicate the smaller lesions on each side. Each of these ulcerations had a reddened base, and irregular edges, somewhat undermined, with only slight surrounding inflammation. On smears then made from the droplets of pus that could be expressed Doctor Blair, the hospital bacteriologist, reported: "Relatively large number of pus cells. No bacteria seen. A fungus is present, identity not established"; and from a culture on Sabouraud's medium: "Organism belongs to group of higher bacteria probably related to streptothrix." No growth was obtained in other media. The same mycelial organism was recoverable again and again from the leg, but no further identification was made.

Doctor Gross, of the dermatological staff, recorded: "A clinical diagnosis is not possible. For sporotrichosis there is not enough gummatous appearance. Blastomycosis is more probable. The cutis seems to be primarily involved." He failed to secure a growth of the organism on Sabouraud's medium.

On October 18 it was noted that the skin had broken down at the side of needle puncture on the medial aspect of the knee. Here a slough formed, extending down to, but not into, the joint. In pus that discharged from this sloughing channel there were repeatedly found mycelial organisms



FIG. 6.—Mycotic ulcerations of the leg. Arrows point to smaller lesions.

TRAUMATIC SYNOVITIS OF THE KNEE

of the same appearance as from the leg, and no other bacteria. In about a month, under treatment by acriflavine and other antiseptic solutions, the sloughing and suppuration ceased and definitive healing took place at that site, with no effect upon the knee function.

Many remedies were tried for the lesions on the leg; iodine (locally, intravenously and, for a long period, by mouth), acriflavine, gentian violet, thymol, potassium permanganate, yeast, boracic acid powder (to overcome a pyocyanous contamination), and ultraviolet light. The most satisfactory progress was made while the areas were dressed with a solution of acriflavine neutral, 1:4000, removed daily for exposure to ultraviolet rays. Doctor Brickner would hesitate, however, to attribute any specific influence to either of these measures.

By November 13 both of the smaller areas on the leg were healed, and the larger one was contracting slowly by peripheral epithelization. By November 30 it was reduced to 50 per cent. of its maximum size and was granulating. Nevertheless, it continued to yield the mycotic organism on smear.

When the woman was transferred to the out-patient department December 31 the ulcer was rather less than two centimetres in diameter. Under treatment by ultraviolet light and mild antiseptic dressings healing was complete by March, 1928—a total period of five months. A small ulceration reappeared in the scar after a few weeks, but gradually healed; and there has been no recurrence for many months. The knee function is excellent. For completeness of record it may be added that the patient gave birth to a normal child at term, that her blood Wassermann reaction was negative, that several of her teeth were in unsatisfactory condition, and that röntgenograms of the knee, after the lavage, showed only slight marginal lipping.

The surgical interest in this case is not so much in the mycosis of the leg, unusual though it was, as in the coincident suppuration in the joint just above. Since no bacteria were found in the pus from within the knee, and since morphologically the same organism as found in the leg lesions were also found, uncontaminated, in the pus that formed along one of the needle tracks, it seems not unreasonable to believe that the pyarthrosis was also mycotic. Very likely the mycelia were present in the smears made from the joint pus and were not recognized as such.

SO-CALLED TRAUMATIC SYNOVITIS OF THE KNEE

DR. WALTER M. BRICKNER, in presenting this case, said the aspiration treatment of so-called traumatic synovitis of the knee is not new. It was employed by Willems twenty years ago and by others before him; and, among members of this Society, it has been recommended by Moorhead, McWilliams, Whitman, and the speaker. Nevertheless, its beneficence and routine usefulness have not found the recognition that the method deserves, either in practice or in text-book teachings.

For many years Doctor Brickner has been routinely aspirating acute traumatic effusions, not only in the knee—which especially lends itself to the method—but also in other joints, even of the fingers. It has been his experience—and Metcalf and Harding had each made the same observations—that in the early stage of an acute traumatic "synovitis" the fluid in the joint is blood or bloody, and the condition is thus, in fact, usually one of hemarthrosis. Only as the blood is absorbed in the course of several days does it become one of "water on the knee". In his article on the aspiration treatment (*American Journal of Surgery*, February, 1925) Doctor Brickner said, referring to the knee: "... it reduces the period of disability from many weeks to a few days, and the period of treatment from two months or more to two weeks or less!", and, "... we must alter our conception of the pathology of

joint sprains. As concerns the knee certainly, and all other joints quite probably, there is in a 'sprain' a tear of the synovial membrane, associated with some injury (break or tear) in ligament, cartilage or bone. An infraction (crack) in the patella, femoral condyles or articular end of the tibia probably occurs more often in knee sprains than is recognized." . . .

To illustrate these postulates concerning both therapy and a not-infrequent etiology, he presented a man, twenty years of age, who, on October 11, 1928, was thrown down by a passing automobile, suffering an injury to his right knee, which promptly became swollen, and an abrasion of the right leg. He was at once removed to a municipal hospital. Therefrom after six days he was brought by his family to the Hospital for Joint Diseases. With him came the official report from the first hospital that the patient "was hospitalized at this institution from October 11 to October 17, 1928, during which time he was treated for traumatic synovitis of the right knee and abrasion of the right leg. X-ray findings reveal 'evidence of synovitis with fluid'."

When admitted to the Hospital for Joint Diseases the right knee was distended with fluid and very painful, especially on attempted motion. Sixty cubic centimetres of blood were withdrawn by needle, which gave prompt relief of pain. A gauze roller was snugly applied, allowing a slight range of motion only; and the patient was kept in bed. Röntgenography, after the joint was thus emptied, clearly showed a marginal fracture of the lateral condyle of the tibia, with separation of a shell-like fragment of bone.

Two days after the first aspiration the joint had become again distended and painful. Forty cubic centimetres of blood were withdrawn and the joint was immobilized on a posterior splint.

Three days later the joint, again distended, was relieved, by aspiration, of fifty cubic centimetres of blood fluid. There was a further slight reaccumulation of fluid during succeeding days, but it gradually disappeared.

November 3 the patient was allowed to walk with crutches, bearing no weight on the injured side. November 6, an X-ray film showing the fragment of bone reattached, weight-bearing was begun cautiously and gradually increased in time allowance. November 9 (about thirty days after the injury), there being no recurrence of fluid or of pain, the patient was discharged. He could then extend his knee fully and flex it 90° ; and the knee was of normal appearance. He has regained full function and has very little discomfort.

A crack in one of the bones entering into a joint may easily escape demonstration by röntgenography, unless exposures are made in several directions and with pains to secure osteal detail. A separation, more or less complete, of a fragment of the articular cartilage over a femoral condyle will not show in röntgenograms unless a bit of bone is torn off with it. Such a cartilage tear is also a cause of "traumatic synovitis of the knee", and of "water on the knee"; and when, after an injury, there is recurrent effusion it is one of the possible causes that deserves prominent consideration.

DR. JOHN J. MOORHEAD thought immediate aspiration was the best method for shortening disability. He agreed that the fluid was rarely serous. He had found practically pure blood in a joint as late as six weeks after the onset of a traumatic synovitis.

Another important point was the flake fractures mentioned by Doctor Brickner and these and other intrinsic sources of joint irritation are often more causative than extrinsic factors in the production of synovitis. The situation is not unlike that which occurs in fracture of the patella. The patient falls and believes that contact with the ground broke the knee cap, although

FRACTURE OF NECK OF FEMUR, OUTER THIRD

the fact is that a contraction of the knee caused the fracture and that it preceded contact with the ground. Many of these cases of traumatic synovitis are due to what might be called joint calculi, and in so-called recurrent synovitis one should always suspect some source of intrinsic trouble.

In closing the discussion, DOCTOR BRICKNER added that routine aspiration is the ideal treatment of "traumatic synovitis" whether the underlying lesion is fracture or merely a "sprain". These cases do much better, he thought, when aspirated at once. In mild cases only one aspiration may be necessary, or possibly two, especially if immediate weight-bearing is not permitted which is apt to cause fresh bleeding. This case was shown, first, to emphasize that what has been called traumatic synovitis is not a simple serous effusion. He recommended aspiration not merely because there is blood there, for he does the same thing when he knows the fluid is no longer bloody. The blood gradually disappears, and even after it has grossly disappeared one still finds red-blood cells and bile pigment in the fluid. Second, in a very large proportion of these cases of "traumatic synovitis" the underlying lesion is a more serious injury than is suspected by simple examination. X-ray pictures taken in several directions and with great care to get bone detail will often show a fracture; and in cases where fracture is not shown there may be tearing off of a piece of articular cartilage which does not show in the röntgenogram unless a layer of bone is attached to it.

FRACTURE OF NECK OF FEMUR, OUTER THIRD

DR. SETH M. MILLIKEN presented a man, sixty-five years of age, who sustained a fracture of the neck of the femur, outer third, October 28, 1926, by being run down. He was admitted to the hospital and immediately put in traction and suspension with the thigh in moderate abduction.

X-ray the succeeding day showed about one inch upward displacement of the outer fragment. Several manipulations were attempted without correcting the deformity, then bone tongs were applied just above the condyles of the femur and twenty-five pounds applied to the cord. This giving over-correction of the deformity, the weight was reduced to seventeen pounds, which held the fragments in almost perfect apposition. This was maintained for two weeks and the weight then reduced to twelve pounds. The tongs were left in twenty-eight days. The leg was suspended in traction in a Thomas splint with Pierson leg piece, with the knee moving throughout the treatment.

November 28, 1926, one month after injury, measurement showed the two thighs symmetrical. There was voluntary motion in hip-joint.

The patient was kept in bed three months and then allowed to be up on crutches and encouraged to use the extremity without weight-bearing.

At the end of five months the patient was using leg normally, though was still using crutches when on the street. Since then he has been walking without support. X-ray fourteen months after injury showed complete bony union with slight increase in the angle at the junction of neck and shaft, that is, reverse coxa vara.

This method is recommended as containing all the elements of Whitman's abduction treatment, with the additional advantage of maintaining the tone of the adjacent muscles, diminishing the amount of atrophy, thereby increasing the nutrition of the part and hastening the bone regeneration.

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FRACTURE OF THE CARPAL SCAPHOID WITH FRACTURE OF THE NECK OF THE RADIUS

DR. JOHN M. HANFORD presented a man, forty-six years of age, who, on January 12, 1925, walked into an open elevator shaft falling one story to the bottom of the shaft. He received numerous contusions, but mainly suffered in his right elbow, forearm and wrist. There was no deformity of the right upper limb but pain and tenderness pretty well localized to the upper extremity of the radius, increasing on rotation and to the outer aspect of the carpus with the special tenderness in the anatomical depression located in the posterolateral aspect of the carpal region.

Radiographs made six days later showed a linear lateral vertical fracture through the scaphoid with no displacement, and a transverse fracture through the neck of the radius just below the head, with some impaction anteriorly. The treatment consisted of a splint to immobilize the scaphoid for eight weeks from the day of fracture, continuously, with active rotation of the forearm after about two weeks.

Two weeks from the injury, during which time the splint had been worn, after consultation, the splint was discontinued. For it was substituted a webbed bandage around his wrist; hot soaks locally; and light active motion on all joints was begun. The avoidance of adhesions to the orbicular ligament at the upper end of the radius was deemed especially important.

Sixteen days after the injury, the patient played the piano, with much pain at both wrist and elbow. By the eighteenth day pain was decreasing and motion increasing. On the twenty-first day he resumed regular work—playing the piano daily. He wore the bandage only until the twenty-eighth day. At the end of eight weeks he had recovered full function; had no pain; and appeared cured. He has had no subsequent trouble.

FRACTURE OF THE CARPAL SCAPHOID

DOCTOR HANFORD presented a second patient in the person of a woman, thirty-five years of age, who tripped on ascending steps December 14, 1928. She fell forward on the base of each palm. At first she had no pain, but within an hour or so noticed moderate pain and numbness in the left wrist and up and down the whole forearm, wrist and hand. Pain increased on motion of the wrist and forearm and increased during the following few days. Her grip was weak, and all heavy lifting was painful. She was seen by the reporter two days after the injury when her symptoms had not reached their maximum and when the signs were so vague that he did not think she had a fracture. He advised a sling, rest, and hot soaks.

Ten days after the injury she was having increased pain. Radiographs were then made of both wrists with the result that a barely perceptible fine linear fracture was seen to run vertically through the scaphoid, transverse to its long axis, with no displacement.

Twelve days after the injury, anterior and posterior moulded plaster splints were applied immobilizing the wrist, carpus, metacarpals and proximal phalanges. Even with these, she continued to have pain and the plan of removal at home for hot soaks and massage resulted in discomfort from inaccurate replacement of the splints.

She was then confined to bed with a mild attack of "flu" for a few days, but even during this quiet period continued to have pain.

January 12, twenty-nine days after the injury, a circular plaster bandage was applied. This has been much more comfortable but even so has not given complete relief from pain.

DISLOCATION OF CARPUS

DISLOCATION OF CARPUS

DOCTOR HANFORD presented a third patient, a man, forty-five years of age, who, on October 13, 1928, was thrown from a horse and injured his right wrist on which there was a small wound which did not bleed. He very soon had a great deal of pain in the wrist and was unable to extend the fingers, in which he felt numbness. Splints were applied by a local doctor. He was first seen by me that same evening. On removing the splints and dressing, the fingers and hand were swollen. The hand was soiled. There was thickening of the wrist from before backward; also a five centimetre transverse, slightly gaping wound on the ulnar side of the front of the wrist. The carpus appeared to be displaced radially. There was a sense of a bony prominence in front of the wrist; though not the typical deformity of a Colles's fracture; and partial anæsthesia corresponding to the median nerve in the fingers. The fingers were flexed at the metacarpo-phalangeal joints and he could not extend them.

A radiograph was taken at once and showed a fracture of the ulnar styloid and evident misplacement of the carpal bones, especially of the scaphoid and semilunar.

He was then anæsthetized in the operating room. The whole extremity including the elbow was thoroughly shaved and scrubbed with soap and water, lime and soda and alcohol, successively, and the small wound was then excised including a bit of lacerated muscle. A temporary dressing was then applied to the wound and traction and counter traction employed. This was continued for several minutes before any manipulation was attempted and after a moment the deformity disappeared and the hand could be moved easily in all directions and the fingers could be easily extended. Hence simple traction apparently had brought about a good reduction without any manipulation.

A suture was placed in each end of the wound. Boric ointment and a sugar-tong moulded plaster splint extending to the middle of the fingers were applied. The reduction appeared most secure with the wrist in slight flexion. The man was tested for hypersensitiveness and then given tetanus antitoxin.

The diagnosis then was compound fracture of the styloid process of the ulna, forward dislocation of the semilunar bone, and anterolateral displacement of the scaphoid with a general lateral shift of the whole carpus except the semilunar.

Films taken the next day indicated a good reduction and this was confirmed by the appearance and comfort of the patient.

The subsequent course was quite uneventful. The splints were left off on the ninth day, giving him a simple bandage. He has had frequent massage, heat, and light active motion consistently. The paræsthesia has not even yet entirely disappeared, especially in the thumb and index finger, and he has occasionally burned his finger with a cigarette.

On January 12 of this year, while riding in a hunt, his horse again fell in jumping and the patient was thrown to the ground. Both of his wrists were damaged and deformed in this fall. When seen by the reporter that same evening he evidently had a left Colles's fracture with typical marked deformity and a fracture of both bones of the lower right forearm just above the wrist. The fractures were reduced under an anæsthetic. There was no evidence of any new carpal injury. Films made the next day showed an apparently good reduction of both extremities and bore out the clinical diagnosis of a Colles's fracture (left) and fracture of the lower extremities of the radius and ulna on the right side. There was an oblique comminuted fracture

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through the lower end of the right radius and a comminuted fracture of the lower end of the right ulna. The fragments were in good position.

Doctor Hanford emphasized again the great advantage of continuous, steady, prolonged traction and counter traction with complete relaxation in reducing fractures and some dislocations of the extremities. Such prolonged continuous traction often eliminates much of the manipulation commonly thought necessary for reduction.

FRACTURE OF RADIAL SCAPHOID

DR. RODERICK V. GRACE presented two cases, the first being a man, thirty years of age, who was injured two and one-half years ago by falling on the outstretched right hand. He was examined within twenty-four hours after injury. He complained of pain and almost complete disability through the right wrist region. On examination there was swelling over the anatomical snuff box and all motions were painful and extremely limited, especially extension. There was marked tenderness over the right scaphoid. This was most noticeable with the wrist in ulnar flexion.

Diagnosis of fracture of the right scaphoid was made and confirmed by an immediate X-ray. The fracture was transverse and through the body of the bone. There was no separation of the fragments. The wrist was immobilized with anterior and posterior moulded splints extending from the fingers to the elbow with the thumb abducted and included in the splint. These splints were removed eight weeks later and patient's further treatment consisted of massage given as often as he could report to the clinic. He wore a wrist strap for protection. Three months later he was able to do full work. At the end of two and one-quarter years his motion is almost completely recovered, there is no pain—although that was his principal initial symptom. Recent X-ray shows bony union.

The second patient presented was a man, approximately thirty years of age. Two and one-half years ago he was injured. The incidents of the injury are too hazy to get an accurate history. He complained of pain and disability in the left wrist. Physical examination showed local tenderness over the left scaphoid, especially with the hand in ulnar flexion. There was almost complete loss of power and function in the wrist. X-ray taken at this time showed a transverse fracture through the scaphoid with a displacement. It was splinted within twenty-four hours of his accident in the usual manner and splints were not removed until eight weeks had elapsed. He reported for full duty within four months of his injury. A recent examination shows his functional and symptomatic result to be perfect. His power is excellent and X-ray taken of his wrist shows bony union to be present.

FRACTURE OF THE CARPAL SCAPHOID

DR. RODERICK V. GRACE read a paper with the above title for which see page 752.

DR. WILLIAM DARRACH remarked as regards pathology that it seemed simpler to him to consider injuries to the proximal row of the carpus in one group. The injury is usually due to a fall on the outstretched hand. It is believed that with the amount of extension at the wrist, the line of force is not transmitted through the metacarpal but is received on the distal row of the carpus. If the wrist is abducted, the scaphoid is then squeezed between the os magnum and the radius. Without the abduction the line of force is more apt to

FRACTURE OF THE CARPAL SCAPHOID

involve the semilunar. He did not remember seeing the association of the fractured metacarpal with an injury to any proximal row of the carpus.

There is one symptom which he believes useful in differentiating between fractures of the scaphoid and other injuries in the neighborhood. Direct tenderness is an indefinite sign because in a normal wrist one can usually obtain a certain amount of tenderness by pressing in the snuff box. If pressure is made over the tuberosity of the scaphoid, the lower end of the radius being firmly held, sudden sharp pain will be noticed in most cases of fracture of the scaphoid, while sprains and injuries to the styloid of the radius do not usually give tenderness with this movement.

The results of treatment by prolonged immobilization with thumb held in abduction, have been much more encouraging than they were before the thumb was immobilized. If the thumb is allowed free motion the distal fragment of the sigmoid is apt to move with it. Following the advice of Doctor Speed during the last year, the position of slight flexion has been used for immobilization in order to relax the anterior ligaments through which the major part of the blood supply reaches the scaphoid. He agrees with Doctor Grace that early cases should be treated conservatively and the operative treatment reserved for late cases with pain. Operative results in his experience showed relief from pain in the majority of cases with almost complete restoration of power, but with distinct limitation of motion at the wrist. He has tried removing the whole scaphoid in a few cases but does not yet feel assured that the results are much better than removal of the proximal fragment alone. When the semilunar is displaced forward with the proximal half of the scaphoid, removal is apt to result in a greater increase in abduction and adduction than when the proximal fragment of the scaphoid alone is removed.

Early massage and movements seem to have been given a thorough trial and he believes that a much larger percentage of cases are treated in this way than those treated by immobilization for eight weeks.

DR. JAMES N. WORCESTER said he thought the question of treatment by prolonged immobilization is doubtful.

Even with union shown in the X-ray he has seen cases with a great deal of discomfort. He thinks cases that do have pain should have operative treatment with the entire removal of the scaphoid and that the most important part of the treatment is immediate motion following removal of the fragments. He disagreed with Doctor Darrach in that cases operated on have had very early relief from pain which is what most of them want. They have had increased function but less power, and, in his experience, in cases of removal of the scaphoid with a perfectly free joint and with absence of pain there was still some loss of power in the grip. As already stated some will get well if we don't do anything. A number of these cases, just as in Colles's fracture cases, are difficult if they have an element of arthritis or synovitis. In this lesion there is a possibility of a combination of arthritis and synovitis, and in a number of these cases it is not to be wondered at that the individual has not only displacement but a good deal of pain.

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DOCTOR WORCESTER does not like to operate on fracture of the scaphoid unless it is proven that other methods are of no help, and before doing an open operation he found that manipulation of the wrist will sometimes release adhesions, restore power and give relief from pain.

DR. JOHN M. HANFORD said that, based on the statistical evidence, it seemed to him immobilization was the best treatment for acute cases. In the presence of the excellent results that have been shown he was in accord with Doctor Grace in accepting these results as indicating prolonged immobilization as the ideal treatment for acute cases.

DR. RODERICK GRACE closed the discussion by the statement that to put the scaphoid in a position of palmar rest, he personally adopted the cock-up position as this was the hardest functional position of all for the patient to attain in case of non-union. He felt in these cases, since most of them were working men, that if they elected to start with the cock-up position they would obtain better functional results.

EDITORIAL ADDRESS

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